STUDY GUIDE FOR
STRUCTURAL PEST CONTROL

The educational material in this study guide is practical information to prepare you to meet the written test requirements. It doesn't include all the things you need to know about this pest-control subject or your pest-control profession. It will, however, help you prepare for your test.

Contributors include the Utah Department of Agriculture and Food and Utah State University Extension Service. This study guide is based on a similar one published by the Colorado Department of Agriculture. Materials for that guide were prepared by Colorado State Extension Service. Other contributors include: Extension Service personnel of California, Illinois, and Georgia. Materials prepared in the previous draft by Metro-Pest Management Consultants, Inc., were used freely and with appreciation in preparing that study guide.

The information and recommendations in this study guide are based on data believed to be correct. However, no endorsement, guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

Other topics that may be covered in your tests include First Aid, Personal Protective Equipment (PPE), Protecting the Environment, Pesticide Movement, Groundwater, Endangered Species, Application Methods and Equipment, Equipment Calibration, Insecticide Use, Application, Area Measurements, and Weights and Measures. Information on these topics can be found in the following books:

1. *Applying Pesticides Correctly: A Guide for Private and Commercial Applicators.* U.S. EPA, USDA and Extension Service, revised 1991.

2. *Applying Pesticides Correctly: A Supplemental Guide for Private Applicators.* U.S. EPA, USDA and Extension Service, December 1993, Publication E-2474.

These books can be obtained from the Utah Department of Agriculture and Food or Utah State University Extension Service. Please contact your local Utah Department of Agriculture and Food field representative or Utah State University extension agent.

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BASIC STRATEGIES

INSPECTION

Inspection includes asking questions of the customer and examining the building thoroughly to learn as much as possible about the pest problem. During the inspection, look for:

- Sheltered areas and conditions of moisture, heat or darkness that favor infestations.
- Food and water that can be used by pests; probable means of entry of the pests (such as incoming food).
- Evidence of infestation, such as damage, droppings, and cast insect skins.

The inspection also should give some idea of the control measures to use, safety precautions that may be necessary during the control effort, and when the work can best be done. Thoroughness during the inspection is of great importance in providing many of these answers.

DIAGNOSIS

Diagnosis includes identifying the pest and any factors contributing to infestation (spilled food, moisture, etc.). Once the pest is located, it must be positively identified in order to proceed effectively. Many times, identification must be made from indirect clues such as damage, droppings, or cast skins. After the pest is identified, it's easier to detect other evidence of infestation, shelter areas, and the means by which the pest gained entry. Some knowledge of the biology of the pest is very useful for thorough diagnosis. Failure to properly identify the pest may result in wasted time, money, chemicals, and effort. Proper identification will make it possible for you to understand much more about the pest and to choose and apply appropriate management techniques.

PRESCRIPTION AND APPLICATION

Prescription includes what, how, when, and where to use the control techniques to correct the problem. Effective prescriptions can only be made after inspection and diagnosis has been completed. The prescription should include not only what can be done for the customer, but what the customer can do in the way of modifying the conditions that created the pest problem, such as sanitation, ventilation or screening. Any limitation of the application should be clearly understood by the customer.

Habitat adjustments often involve sanitation efforts to remove sources of food or water that the pest needs to survive. Thorough sanitation can largely eliminate many pest problems. However, failure to provide effective sanitation can prevent other techniques, such as pesticides, from working effectively. If good sanitation practices aren't being followed by the customer, their importance must be tactfully explained. Exclusion of pests to prevent reinfestation should be part of any prescription. This can involve screening, caulking cracks and crevices, and blocking other points of entrance. It can also involve controlling the movement of potentially infested products into the area. Pesticides are often used to supplement other control methods against household pests. When properly prescribed, these are used in a targeted way in areas visited most often or inhabited by the pests. Because of potential hazards, choice of pesticides and their application also depends on other characteristics of the site, such as closeness to human food, access by children or pets, and ventilation systems. Remember, pesticides must be labeled for the pest and the site being treated.

EVALUATION

Any good pest-control program should include a system of ongoing evaluation. Changes in pests and their susceptibility to pesticides occur continually, as do products available to the pest-control operator. Periodic inspections to assess effectiveness are very useful.

INSECTS AND INSECT RELATIVES

Insects comprise one group of animals within a larger group called the **ARTHROPODS** (meaning jointed foot). All arthropods possess the following combination of characteristics which make them distinctive:

- Segmented body
- Jointed appendages
- Skeleton on the outside of the body (exoskeleton)
- Growth involving molting

Insects, as a distinct class of arthropods, also possess the following combination of characteristics:

- Three body regions (head, thorax, abdomen)
- Three pairs of legs (restricted to the thorax)
- One pair of antennae
- Wings (usually) in the adult stage

Characteristics of the other common arthropod groups (classes) are:

Crustaceans (crayfish, shrimp, sowbugs, pillbugs)
Five to seven pairs of legs
Two body regions (cephalothorax and abdomen)
Two pairs of antennae.

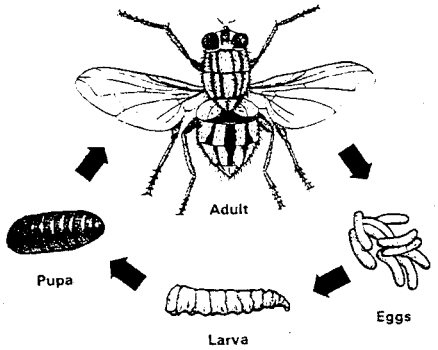
Arachnids (spiders, ticks, mites, scorpions)
Four pairs of legs
Two body regions (cephalothorax, abdomen)
No antennae.

Diplopods (millipedes)
Elongate, usually rounded bodies
Numerous body segments (typically around 50)
Appear to have two pairs of small legs at each segment.

Chilopods (centipedes)
Elongate, flattened bodies
Fourteen to twenty body segments
Appear to have one pair of legs at each segment.

INSECT GROWTH

All insects begin their development as eggs produced by the adult female. Although a few species, such as aphids, may also appear to give live birth, this occurs from the eggs hatching inside the mother.



Life cycle of the house fly.

After egg hatch, insects grow in a series of distinct stages. Each stage (instar) is separated by a period when the insect sheds (molts). Its exoskeleton, which is produced during molting, is larger than the previous one. A few hours after a molt, the new exoskeleton becomes hardened, and there is no further change in body size until the following molt. Body parts that remain soft, such as the thorax and abdomen of caterpillars, may expand to a limited extent during the course of an instar. All growth ceases following the final molt to the adult stage of the insect. (A small fly will remain a small fly; it is not a "baby" large fly.)

As insects develop, there are also changes in form. These changes are called metamorphosis. The kinds of changes may vary among different insect groups, but two general types of metamorphosis predominate, simple meta-morphosis and complete metamorphosis.

Insects undergoing simple metamorphosis have three basic life forms -- egg, nymph and adult. The nymphs typically pass through three to five instars. Nymphs and adults often live in the same habitat, with the principal changes during metamorphosis being size, body proportions, and the development of wings. Some insects which undergo simple metamorphosis include grasshoppers and crickets, earwigs, the "true" bugs (Hemiptera), aphids, and related insects.

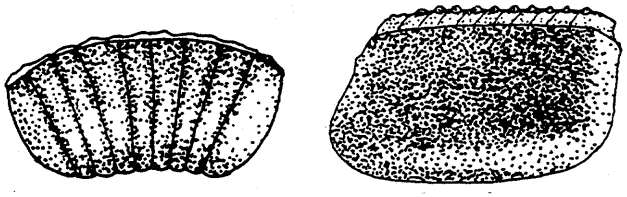
Insects that undergo complete metamorphosis pass through four basic life forms -- egg, larva, pupa and adult. Caterpillars, maggots and grubs are typical examples of larvae. During the larval stage, there may be three to seven instars, during which the larvae usually feed. The pupal stage (cocoon, puparia, chrysalid) is a non-feeding stage. During that stage, the insect changes to the adult form. Adults are usually winged, and they may differ from the larvae in a number of ways, including type of legs, mouthparts, and feeding habits. Adults of insects undergoing complete metamorphosis are very different from the larvae and may be found in very different habitats. Insects with complete metamorphosis include butterflies and moths, beetles, flies, and lacewings.

COMMON HOUSEHOLD PEST PROBLEMS IN UTAH

COCKROACHES

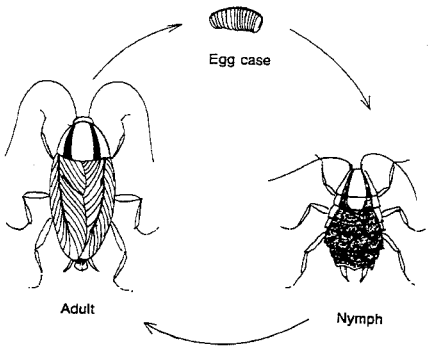
Cockroaches are oval, flattened, fast-moving insects. They have long, hairlike antennae and a broad saddlelike plate (pronotum) that covers the head. Adult stages of most species have wings, with the front pair being thickened and leathery. Cockroaches go through gradual metamorphosis, with three basic stages in their life cycle: egg, nymph and adult. The eggs are laid in beanlike egg capsules, called ootheca, which may contain several dozen eggs. These egg capsules are often dropped around food sources or glued to surfaces, although some cockroaches carry the capsule during its development.

The immature stages are called nymphs. Several nymphal stages occur, each separated by a molt. The nymphs generally appear similar to the adult stage, but they lack wings and are smaller. Typically, two to three months pass while they complete their life cycle.



Brown-banded *American*
Cockroach ootheca

Cockroaches are among the oldest group of insects known, with fossils dating back 200 million years. As a group, the cockroaches have shown exceptional ability to adapt to and survive in a wide range of environments, including human dwellings. Most cockroaches are capable of developing on a wide range of food, and their flattened body form allows them to move into most areas. Cockroaches have also developed a high level of resistance to many commonly used insecticides.

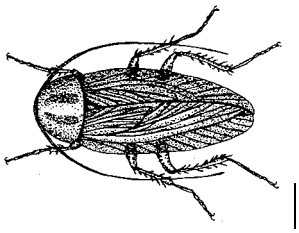


Life cycle of the cockroach

Cockroaches can enter buildings and containers of all kinds. They also may enter around loose-fitting doors and windows and through utility lines, and they may travel through sewers. Once within a home, cockroaches tend to prefer warm, dark, moist shelters and are often found near kitchens and food-handling areas. Since cockroaches are nocturnal, they are rarely seen during the day.

Aside from their importance as a household nuisance, they may soil areas with their salivary secretions and excrement, leaving an unpleasant odor. Cockroaches and cockroach parts also produce allergic reactions in some humans. Cockroaches haven't been found to be direct carriers of human disease. However, their habits of feeding on filth or disease organisms make them well suited to mechanically contaminate food or utensils. They are suspected of helping to spread diseases such as dysentery, diarrhea, and food poisoning.

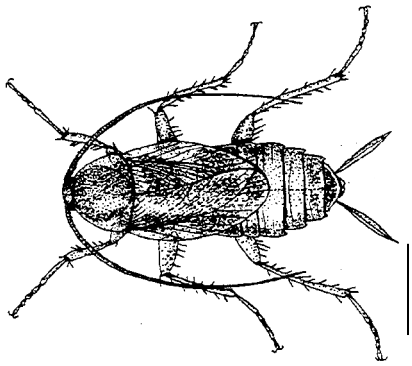
Most cockroaches are tropical or subtropical in origin and possess generally harmless habits. However, a few have developed into serious pests, including several species of cockroaches that have been introduced into Utah. Habits of the common pest cockroaches found in the state are summarized below:



German cockroach

German Cockroach (*Blatella germanica*)

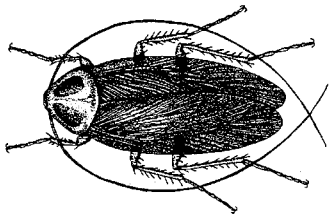
- German cockroaches are the most common species in Utah.
- Adults are pale brown to tan and about one-half inch long.
- Adults have wings and are distinguished by having two dark stripes that run lengthwise along the pronotum, behind the head.
- This species has the highest reproductive potential (number of eggs laid and shortest life cycle) of the house-infesting cockroaches.
- Females carry their egg capsule, protruding from their abdomen, until the eggs are ready to hatch. Females produce about four to eight capsules in their lifetime. Each capsule contains 30 to 50 eggs, which hatch in about 28 days at room temperature. The eggs usually die if the mother is killed.
- Females live an average of 250 days.
- German cockroaches will generally be found close to moisture and food, such as in kitchens and other food areas, restrooms, and around plumbing fixtures. Surveys should concentrate in cracks and crevices, under table tops, behind sinks, in cabinets, in motor areas of refrigerators, in and around kitchen equipment, and similar sites.
- Infestations found scattered throughout a building, including non-food areas, indicate very high populations.



Brown-banded cockroach

Brown-Banded Cockroach (*Supella longipalpis*)

- Brown-banded cockroaches are the smallest cockroach found in Utah, slightly smaller than the German cockroach.
- Brown-banded cockroaches vary from light tan to glossy dark brown in color. The adult stages are marked with two light-colored bands at the base of the wings.
- Brown-banded cockroaches usually glue their egg capsules to surfaces in dark areas such as cabinets, chairs, boxes, drawers, and high areas of a building. Because of this habit, they are easily transported to new buildings.
- Females produce about 14 capsules during their lifetime, averaging 18 eggs in each capsule. Eggs hatch in about 50 to 75 days.
- The adult female may typically live about 200 days.
- Brown-banded cockroaches tend to scatter thoroughly through a building. They prefer areas of higher temperature (80 degrees F. or higher). Brown-banded cockroaches tend to occur more often in homes, apartments, hotels and hospitals than in stores or restaurants.



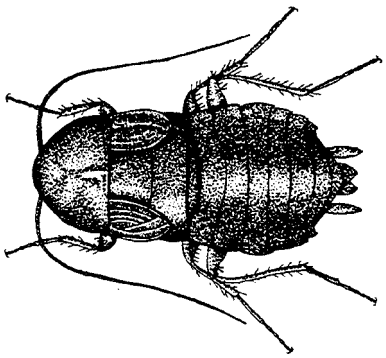
American cockroach
(Periplaneta americana)

Oriental Cockroach (*Blatta orientalis*)

Oriental cockroaches are not as common in Utah as the brown-banded cockroach and the German cockroach.

- Adults are about one inch long and dark brown or black in color.
- Wings of the oriental cockroach are short. Females only have small wing pads, while males have wings that only cover about three-fourths of their abdomen.
- Females drop egg capsules in warm, sheltered areas near a food supply. Each female produces an average of eight egg capsules, each containing about 160 eggs. Under room-temperature conditions, eggs hatch in about 60 days.
- Adult females may live about 180 days.
- Oriental cockroaches are almost always found around moist, dark sites. Common habitats include floor and storm drains, water-meter boxes, around plumbing fixtures, moist crawl spaces, sewers, and around garbage.
- This species is often referred to as the "waterbug."

- Oriental cockroaches may be found outdoors during the warmer months of the year.
- Oriental cockroaches are rather sociable, and clusters of them may be found in favorable habitats. They are seldom found high on walls, in high cupboards, or in the upper floors of buildings.



Oriental cockroach

Cockroach Control

The control of cockroaches requires a great deal of care and planning on the part of the pest-control operator. Several steps and techniques are involved in effective control, and these must be used in a coordinated manner. Cockroach control also usually requires a great deal of cooperation from the client to change environmental conditions that contribute to infestations.

Detection

The site should be thoroughly surveyed to determine the extent of the infestation and to identify the type of treatments that will be required. Fundamental to this is determining the cockroach species present. Since different cockroach species have differing habits, this will allow treatments to be better targeted. A search should be made of all suspected hiding places. Since cockroaches are rarely active during the day, this can be difficult. "Flushing" sprays of pyrethrins can be used to irritate cockroaches and cause them to move out of their hiding areas.

Sticky traps can also be useful to help to detect cockroach "hot spots." Several different types of traps exist, and some also contain the sex-attractant chemicals used by certain cockroach species. These traps should be placed in areas where cockroach activity is suspected, and they should be checked after a few days. Traps can also be used to help control cockroaches, but they aren't an effective substitute for other control practices.

Sanitation

Sanitation is fundamental to cockroach control. Any methods that can be used to deny cockroaches the food, water and shelter they need will greatly aid in control. Cleanliness and good housekeeping are essential. Food should be kept in tightly closed containers and should not be left exposed. This includes spilled materials, garbage, food scraps left in sink areas, and pet foods.

Water is an important need of cockroaches. Dripping faucets, leaking pipes, and other sources of moisture should be eliminated. Bottles and cans to be recycled should be stored outdoors, if possible. Sewer openings should be screened.

It's also important to remove potential sources of reinfestation. Cracks, crevices, and other openings should be sealed. Pipes should be caulked and sewer drains screened. All materials being moved into the building should be checked for evidence of cockroach infestation.

Chemical Control

Several approaches to chemical control are possible. Regardless of the chemical or formulation chosen, applications made near regular hiding places will be most effective, since they allow more contact. Chemical controls usually provide only temporary suppression, especially when they aren't combined with a vigorous sanitation effort.

Another serious limitation of insecticides is the development by many cockroaches of resistance to the chemicals. Many populations of German cockroaches are no longer susceptible to several insecticides that formerly were effective. Furthermore, cockroaches are repelled by several chemicals and will avoid treated surfaces.

Often, where no previous control has occurred, the initial treatments consists of a thorough "cleanup" or "clean-out." During this treatment, sprays or dusts are applied thoroughly throughout the building. As a result of this thorough treatment, there is often an immediate reduction in cockroach numbers. However, cockroaches are rarely eliminated by a single treatment, since egg capsules aren't killed. Also, some cockroaches may

remain hidden in, or migrate to untreated areas. For this reason, follow-up treatments are required.

Control chemicals can be oil-based sprays, water-emulsion sprays, dusts, tracking powders or baits. Choice of the type of treatment should be matched to the conditions of the infestation site. Most treatments involve sprays in order to provide a residual effect. These applications leave a toxic residue on the treated surface that cockroaches pick up when moving across it. The length of time that treatments remain effective varies, depending on such factors as the concentration of chemical applied, choice of insecticide, and application surface. Two to four weeks of residual activity is fairly typical.

Sprays should be applied to cockroach harborages, with emphasis on cracks and crevices. There should be minimal application to exposed surfaces. If exposed surfaces are treated, a low-pressure spray should be used. Avoid runoff or puddling, and immediately wipe off excess spray. Oil-based sprays shouldn't be applied near open flames, to tile floors, or onto plants. Water-based sprays shouldn't be used near electrical outlets.

Several precautions should always be taken when making insecticide applications for cockroach control. Pets should be removed from the treatment area during application, and all aquariums should be covered. If sprays are to be applied to areas where food, cooking utensils or dishes are stored, these items should be covered or removed prior to spraying. Furthermore, applications around these sites must be limited to cracks and crevices, avoiding exposed surfaces. Also, treatments made near air ducts and ventilation systems should be done with extreme care to avoid air contamination.

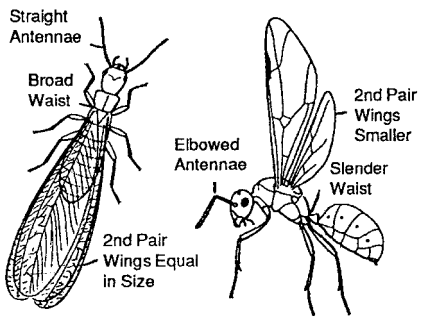
Dusts and tracking powders are able to penetrate cockroach hiding areas that sprays may not reach. They are also useful on very rough surfaces or on surfaces that would absorb liquid sprays. They may kill the insect by having the chemical penetrate the insect body or be swallowed as the cockroach cleans its antennae and legs. When applied to dry locations, they also last longer than do residual sprays. Dusts should be applied as thin films, since heavy concentrations can repel cockroaches. Some dusts, such as boric acid, may be applied in water, which quickly dries, but to be effective, dusts must remain dry. Dusts are not appropriate for use in areas where they would be unsightly or cause contamination problems.

Baits are generally long-lasting and can be applied to areas that can't be treated with sprays or dusts. Baits include an attractant such as peanut butter or syrup in combination with a non-repellent type of insecticide, such as boric acid. Often, baits may be placed inside small containers to help keep them away from pets and humans. To be effective, baits should be used in small amounts placed in many locations. Effectiveness of baits is greatly dependent on the amount of competing food sources available. If sanitation efforts haven't been thorough, baits perform poorly.

ANTS

Ants are social insects that produce a colony made of various specialized types of individual ants. Most ants are known as workers; they are wingless, do most of the food foraging and rearing of young, and defend the colony. Eggs are produced by the large queens, which have wings until after they have mated. Smaller winged ants found in colonies are the males. Ants are characterized by having a very narrow, pinched "waist" and antennae that are bent, or elbowed. They are sometimes confused with termites, especially when swarms are produced. However, termites have a broad waist and beaded antennae.

Development of ants involves complete metamorphosis. Eggs are extremely small. The developing larvae are fed by the worker ants and pass through several molts before pupation. The pupae don't feed and are immobile, soft and white. Ant nests usually are produced underground, and colonies can contain tens of thousands of workers. The large carpenter ants build nests in wood, usually wood that is partially decayed. Relatively few ants in Utah form a nest indoors, the pharaoh ant being an important exception.

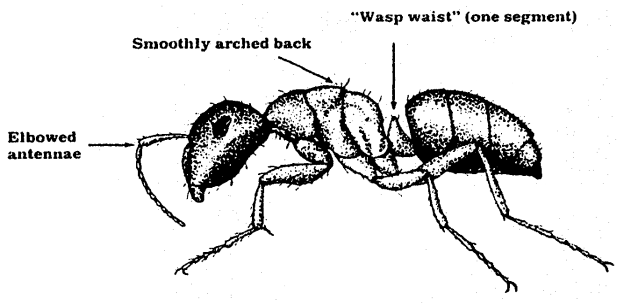


Termite *Ant*

Ants feed on a wide variety of different foods. Sugary materials are preferred by some species; others mostly feed on fatty or protein-rich foods. Some ants are important predators of insect pests.

However, problems with ants often occur when they forage for food indoors during the warmer months. In addition, carpenter ants can cause structural damage, and house-infesting species, such as the pharaoh ant, can mechanically move disease organisms around. Following are descriptions of some common species of ants.

Carpenter Ants (*Camponotus sp.*)
Carpenter ants are the largest ants (one-fourth to one-half inch). Often they are black or dark brown, although some eastern plains species are lighter in color. The most distinctive habit of carpenter ants is their nesting in wood. The ants excavate galleries and pile coarse sawdust at the nest openings. Unlike termites, carpenter ants don't eat wood; instead, they scavenge on dead insects, insect honeydew, and other materials.



Carpenter Ant Worker

Carpenter ants almost always nest in wood that is soft because of water and decay damage. Rarely, nests originating from damaged wood will later extend into sound wood, causing structural damage. Carpenter ants don't sting, but they can produce a mildly painful pinch from their jaws.

Harvester ants (*Pogonomymex sp.*)
Nests of the harvester ants are very conspicuous, since they often produce large mounds. The ants are fairly large and red or dark brown in color. Harvester ants primarily feed on seeds and may clear the vegetation from the area around the mound. They rarely enter homes. Harvester ants have a mildly painful sting.

Field ants *(Formica sp.*)
There are a great many species of field ants. These ants are medium-sized, and they may be brown, red, black, or any combination of these colors. Nesting occurs outdoors, often near pavement. The ants are attracted to sweets.

Cornfield ants (*Lasius sp.*)
Nests of the cornfield ants occur in fields and around homes. Typically, nesting sites in yards include brick or stone walls, cracks in the pavement, beneath rocks, and sometimes in openings around foundations. They don't nest in the house, but they often forage inside in search of sweet materials.

Pavement ant (*Tetramorium caespitum*)
The pavement ant can be one of the most frequent nuisance-ants in areas of the state where they have become established. They are small, blackish-brown ants with pale legs and antennae. As the name might suggest, pavement ants commonly nest under pavement slabs, especially next to lawn areas. Rocks and areas under slab-construction homes also have been commonly used as nest sites. Foraging in the home most commonly occurs during summer, but nests adjacent to homes can allow foraging to occur year-round.

Pharaoh ant (*Monomorium pharaonis*)
One of the most persistently annoying and hard-to-control ants in homes is the pharaoh ant. Pharaoh ants are very small and yellow or pale red. Unlike most other ants, pharaoh ants have adapted well to nesting indoors, and colonies may spread throughout a building. In addition, pharaoh-ant colonies readily split into smaller colonies when disturbed.

Pharaoh ants have a wide range of foods that include syrups, jellies, grease, cake, and pet foods. They are especially serious pests in hospitals, since they are known to visit patient wounds.

Thief ant (*Solenopsis molesta*)
The thief ant is one of the smallest ants found within a building, similar in size to the pharaoh ant. However, its habits differ considerably from many other ants found in the region, since it primarily develops in association with colonies of other ant species. Because of their small size, thief ants can move around in small tunnels of other ant colonies and may move about and kill other immature ants. Within homes, thief ants forage on greasy foods. Nests can occur in a wide variety of locations, but they are almost always located outdoors.

General Ant Control

Sanitation is an important aspect of any ant-control program. Crumbs, grease, food scraps, and other foods attractive to foraging workers should be eliminated. Heavy infestations of ants in buildings are rarely found where thorough sanitation is practiced. Sanitation is also important to increase the effectiveness of ant-baiting. Most species of nuisance-ants nest outdoors. Perimeter treatments with residual sprays applied around foundations can prevent many ants from foraging indoors.
For more permanent control, nests can be located and attacked; dusts are usually more effective for this than sprays, since the dusts are more readily tracked into the colony. Also, slow-acting insecticides are the most useful, since they allow the forager time to return to the nest so the poison can be fed in the colony, killing queens and young.

Control of some ants, such as carpenter ants and pharaoh ants, requires more specialized treatment.

Carpenter Ant Control

Effective control of carpenter ants requires finding the nest. Carpenter ants don't accept baits readily, and residual treatments fail to kill colonies. When carpenter ants are found in a building, they are either nesting inside the building or nesting outside the building and entering to forage for food. In some circumstances, an entire colony may migrate from one nesting site to another, so it's important to eliminate any nest outdoors as well as any indoors.

The indoor inspection should concentrate on looking for areas of wood associated with high moisture. Critical areas include plugged drain gutters, poorly fitted or damaged siding and flashing, wood-shingle roofs, hollow porch posts and columns, and leaking doors and window frames. Look for wood in contact with soil and wood in crawl spaces or under dirt-filled slab porches. When looking for a nest indoors, look for:

1. Piles of wood debris ejected from the colony. This debris has a shredded quality that looks somewhat like shavings found in pencil sharpeners. It's similar to that produced by some wood-boring beetles that are common in firewood. Sometimes this debris is deposited in the voids in the wall and isn't visible.
2. "Windows" or small openings to the nest. "Windows" may not always be present, since existing cracks may be used by the ants.
3. Ant activity. The ants often forage in kitchen pantries, garbage, and other areas for food. Often, relatively few ants are seen during the day, as they are more active at night.
4. Swarmers. These may be found trapped in spider webs.
5. Damaged timbers. The surface may appear solid, but by sounding, the damaged areas can be located.

Sound detection is sometimes useful in carpenter-ant nest location. An active colony at times produces a distinct dry, rustling sound that may be heard from outside the nest. Sometimes the noise is very loud, but generally it can only be heard when conditions are very still and outside noises are at a minimum. Control of carpenter ants indoors should involve:

1. Elimination of high-moisture conditions that provide wood conditions suitable for carpenter-ant nesting.
2. Insecticide application to nests and nest areas. Dusts are especially effective in treating nest galleries. Nest treatments may be used with dusts or in conjunction with sprays. However, spraying or dusting the infested area with residual insecticides without locating or treating the nest itself usually doesn't result in complete control . The insecticides should be applied to reach, as much as possible,

areas inhabited or traveled by the ants. The extent of the galleries should be determined to whatever degree is practical by careful inspection and drilling.

Pharaoh Ant Control

Pharaoh ants are unusually well-suited to nesting indoors, and most colonies will be located within buildings rather than outdoors. They are also poorly controlled with residual sprays, since irritating chemicals (including solvents and many cleaners) may cause the nest to "bud" into separate colonies, that disperse throughout the structure.

Use of slow-acting baits has been most effective for pharaoh-ant control. Sweet baits, especially mint-apple jelly, are readily accepted by foraging workers. However, pharaoh ants may later become saturated by the sweet baits and no longer accept them. Use of fat-based materials, such as peanut butter and honey, in combination with sweets are often effective for a longer period than are sweet baits alone.

To improve bait acceptance, sanitation is essential. Failure to restrict other food sources will result in poor bait acceptance. Since the purpose of baiting is to get the ants to feed on the bait and return it to the colony, residual insecticides should not be used in the area of the baiting. It's also important to avoid use of volatile cleaners and solvents, which may repel pharaoh ants. Residual insecticides can be used as a preventive treatment in areas where ants are not present.

SILVERFISH AND FIREBRATS

Silverfish and firebrats are flattened insects that are broad near the head and tapered toward the rear of the abdomen. They are wingless and covered with scales, and they have long, slender antennae. Three long, slender appendages from the rear of their body are also very distinctive, giving them their common name, "bristletails."

Silverfish are covered with silvery gray or tannish-gray scales. They prefer areas of some moisture and are usually found underneath boxes, boards, and other debris. The firebrats are more mottled in coloration. Firebrats prefer very warm areas and are usually found near heating units.

Both silverfish and firebrats feed on starchy and protein-rich materials. Natural fabrics and rayon, highly refined paper, glue and paste, and books or linens are among the many food items used by these insects. They also may soil items by leaving yellowish stains.

Silverfish and Firebrat Control

Chemical control of silverfish and firebrats is somewhat similar to that used for cockroach control. Hiding areas should be thoroughly treated with sprays or dusts. Attention should be given to wall voids and attics, where these insects are often found. Environmental modifications should also be considered for long-term control. Boxes, furniture, and other items that provide shelter should be moved to deny the insects favored hiding areas. Increased circulation can help to decrease temperatures around heating pipes, making the site more unfavorable to firebrats.

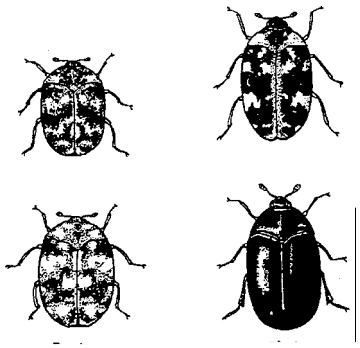
BOOKLICE/PSOCIDS

Psocids or booklice are small, pale-colored insects that are found outdoors feeding on molds under bark, in piled grass clippings, on damp wood, and in similar locations. Occasionally, they may also enter homes and occur as nuisance-pests. Since psocids require high humidity and feed on molds, almost all household infestations are located in warm, dark, moist areas. Bathrooms are the most common site of infestations, but leaking pipes can also provide suitable conditions. Newer homes may be more likely to be infested, since higher-humidity conditions generally occur for a few months after construction. Psocids can become very abundant and annoying. However, they rarely cause much damage to stored products. Control of psocids should involve methods of eliminating moisture sources by improving ventilation and repairing leaks.

CARPET BEETLES

Various species of carpet beetles are found throughout Utah. Unlike cockroaches, carpet beetles commonly occur outdoors and can invade homes by flying. As a result, almost all homes have some carpet beetles present. Eggs are laid around foods used by the developing larvae. Carpet-beetle larvae are distinctive, being light brown in color and having an elongated, tapering shape.

Also, carpet-beetle larvae are rather bristly, often with long hairs protruding from the hind end. Carpet beetles are fairly slow to develop and may require several months or even a year to become full-grown. Carpet beetles are scavengers that feed on a wide range of plant and animal materials. However, they prefer animal-based products, such as wool and skins. Household lint or small animals that have died in the vicinity of the home are common materials on which large numbers of carpet beetles may breed. The carpet beetles' name is based on their former importance as a pest of woolen carpets. Carpeting of synthetic fabrics isn't susceptible to these beetles. Carpet beetles are most damaging to items such as woolen fabrics, stuffed animals and furs. They are far more common than are clothes moths, another major group of fabric pests. Residual populations also may breed on debris that collects in or under furniture, around the edge of carpets, or in cracks and crevices.



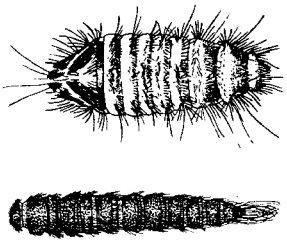
L to R, Top to bottom: Varied, Common, Furniture, and Black Carpet beetles

Infestations of carpet beetles in pantries are much less common than those of flour or sawtoothed grain beetles. Carpet beetles are relatively slow to develop, requiring about a year for a generation on cereal products. However, since the insects are highly mobile, infestations may recur annually.

Carpet Beetle Control

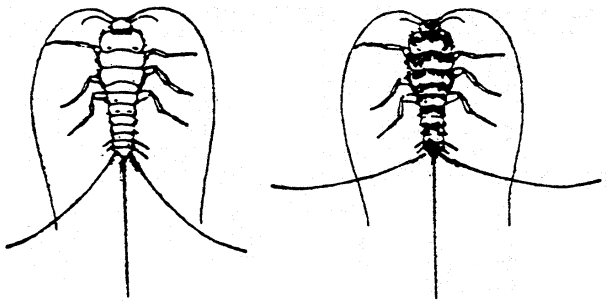
Detection of carpet-beetle breeding areas is the first step toward their management. Materials most likely to be infested should be carefully examined for the presence of the insects or for the shed skins of the larvae. Heavily infested materials should be discarded, if possible. If not, they may be treated in some manner to kill the insects. For small items, deep-freezing is possible, since the insects would normally be killed within three to four days of exposure to 0 degrees F. temperatures. Fumigation may be necessary for some items. Use of paradichlorobenzene (PDB) moth crystals confined with carpet beetles can kill adult and larval stages in non-food products. Large items, such as furniture, may need to be removed to a fumigation chamber.

A thorough cleanup of the area is also important for carpet-beetle control. Household lint, collections of dead insects around window wells, and other debris can be an important food source for carpet beetles. If very large populations of carpet beetles suddenly occur, also look into areas where a dead bird or rodent may have become trapped. Sprays may be used to improve control of carpet beetles. However, the "furry" nature of the varied and furniture beetles, as well as the natural resistance to insecticides of the black carpet beetle, also tend to protect these insects, especially against water-base sprays. The use of wetting agents in both oil and water sprays can greatly improve coverage and penetration.



Carpet beetle larvae

Treatments should be applied to areas where carpet beetles tend to concentrate, such as cracks and crevices. If carpeting is to be treated, chemicals should



Silverfish *Firebrat*

be applied so that penetration is deep enough to reach

the base pile but not enough to wet the rubber or synthetic backing. These materials, as well as many kinds of tiling, may be damaged by oil sprays.

CLOTHES MOTHS

Infestations of clothes moths are relatively rare in Utah. Occasional infestations arise from the purchase of infested items coming from countries where clothes moths remain a common pest. Adult clothes moths are small (about one-fourth inch long) and yellow- or buff-colored. They are easily distinguished from the other common household moth, the Indian meal moth, by not having distinctive dark banding along the end of the wing.

Larvae of the clothes moths develop by feeding on woolen fabrics and furs. Webbing may be produced by the caterpillars as they feed, and one species weaves the silk into a case in which it lives. In a warm building, several generations may be produced during the year.

Clothes Moth Control

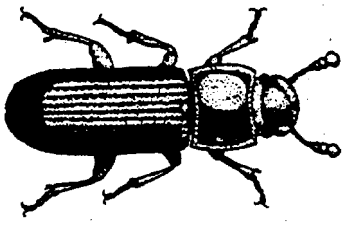
Female moths rarely fly until they have laid most of their eggs, so killing the flying moths is ineffective for control. Items known to be infested and susceptible items stored nearby should be treated in a way that will kill the eggs and larvae. Dry cleaning or storage with paradichlorobenzene (PDB) moth crystals can kill all stages of the clothes moth. Use of DDVP (dichlorvos) pest-strips can also kill many of the insects. Proper storage is very helpful in preventing clothes-moth infestations.

Tight-fitting containers may be used to store susceptible clothing, although the young caterpillars can penetrate fairly small openings. Cold storage can also prevent or retard infestations.

COMMON PESTS OF STORED FOODS

FLOUR BEETLES

Flour is most commonly infested by either of two closely related beetles, the confused flour beetle or the red flour beetle. Small pieces of cracked grains may also be sources of flour-beetle infestation.

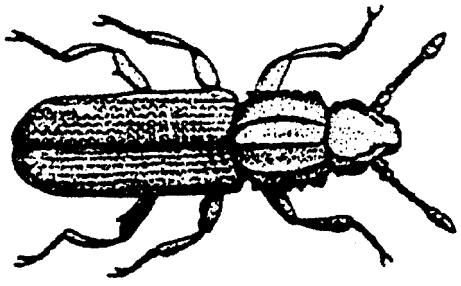


Flour beetle

The adult flour beetles are reddish-brown in color and less than one-eighth inch long. They are sometimes called "bran bugs," since they are so common in milling operations. Both species of flour beetles have wings, but rarely, if ever, do they fly. Immature stages are pale-colored and wormlike. On close inspection, a pair of pointed forks can be seen on the hind-body segment. Development of the immature stage typically takes one to two months, and adults lay eggs over a period of five to eight months. Both adult and immature stages feed on flour.

SAWTOOTHED GRAIN BEETLE

The sawtoothed grain beetle is often the most common beetle found infesting coarser cereal products. It can develop in flour, but most infestations occur in processed-grain products such as breakfast cereals, oatmeal, corn meal and pasta. Dried fruit and chocolate are occasionally infested. The adult beetles are about one-tenth inch long, similar in size to the flour beetles. They are elongate in general body shape, flattened, and distinctively marked with a series of saclike projections along the sides of the thorax. They have wings, but they have never been observed to fly.



Sawtoothed grain beetle

Eggs are laid in crevices in the food supply. The larvae are yellowish-white with a dark head and wormlike in shape. Larvae feed on the same foods as do the adult

stages. Under optimal conditions, they can complete a generation in less than two months. Adult beetles may live for a year or more.

SPIDER BEETLES

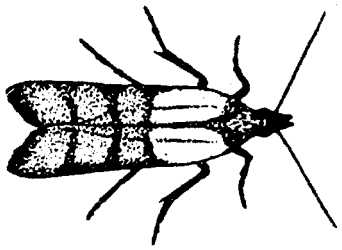
Spider beetles are larger than the other common stored-products beetles and appear similar in shape to a spider. However, the three pairs of legs easily distinguish them from the eight-legged spiders. Spider beetles can infest a wide variety of animal or vegetable products. They are most commonly associated with grains, although feathers, wool, dried meat, and other products can be eaten. Eggs of the spider beetles are white and may be conspicuously laid around food products. The larvae are C-shaped and resemble small white grubs. Pupation of spider beetles often occurs in small cavities that they chew out of wood or other soft materials.

INDIAN-MEAL MOTH

The Indian-meal moth is an extremely common insect found infesting food products in Utah homes. Almost any coarse grains (oatmeal, grits, etc.), nuts, seeds, dried pet foods, spices, dried fruits or vegetables are suitable materials for Indian-meal-moth development. However, flour is rarely infested.

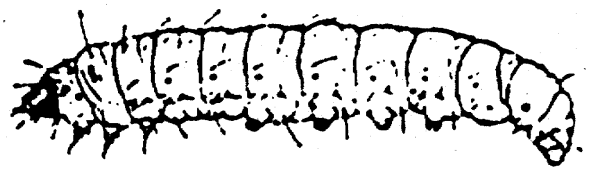
The adult stage of the Indian-meal moth is about one-half inch long, generally gray in color with bronzy wing tips. The moth is a common small moth found flying in Utah homes. Feeding damage is done by the larvae ("worms"), which are usually light-colored (pale yellow to pink) with a dark head. When feeding, the larvae produce webbing that is mixed with food particles and droppings.

Indian-meal moth occurs throughout the United States and is an established insect in almost all large, permanent storages of susceptible foods. Most household infestations originate from the inadvertent purchase of infested products. During warm months, localized movements of the moths may also occur outdoors, resulting in household infestations. It's rarely possible to definitely establish the original source of a meal-moth infestation.



Indian-meal moth

Eggs are laid by the adult moths near suitable foods, such as along cracks or folds of packages. The newly hatched larvae are very small and are capable of penetrating into loosely closed packaging. Upon reaching a suitable food, they begin to feed. Development can be rapid under favorable conditions, and the larvae ultimately reach a length of about one-half inch. After they finish feeding, the larvae will often wander away from the food source to seek a place to pupate.



Indian-meal moth larva

Pupation then occurs, after which the adult moths emerge. Adult female moths are capable of laying 200 to 400 eggs during their lifetime of several weeks. The time needed for complete development of the Indian-meal moth varies, depending on temperature and food, but it typically takes at least a month to complete.

Control of Insects Infesting Stored Foods

Control of insects infesting stored foods requires a thorough search of all food areas. Flour, nuts, and other dried food in storage areas are common places to start the inspection. Infestations in cupboards usually involve foods that haven't been used for a long time. Also check commonly overlooked areas, such as pet foods, crafts made of grains, and bird seed. Look for the presence of larvae and other evidence of infestations. For example, webbing is a positive means of identifying an infestation

of Indian-meal moth. Old larval skins are often left by beetles.

Infested materials should be discarded, if possible. Since the larvae can also feed on spilled foods, the cupboard areas should be thoroughly cleaned. Remaining items that are susceptible should be treated to kill the insects. Deep-freezing for several days or heating to 125 to 130 degrees F. for a few hours can be effective. All foods that are known to be insect-free should be stored in tight-fitting containers to prevent reinfestation.

Insecticide use around food-storage areas can help supplement, but not replace, sanitation. If insecticides are to be used, they must be restricted to crack and crevice treatment. If commodity storages are infested, fumigation may be necessary.

DOMESTIC FLIES

Several species of domestic flies may enter homes and create serious nuisance problems. Many flies also can be important in the transmission of diseases. For example, flies that develop in manure and filth, such as house flies, face flies, and blow flies, are commonly contaminated with disease-causing bacteria. The movement of flies between filth and human food has been associated with several diseases.

Flies (order: Diptera) undergo complete metamorphosis. The winged adult stage is most commonly observed feeding on liquids that are usually sponged with their mouthparts. Immature stages of flies are pale, legless maggots. After becoming full-grown, maggots often wander from the breeding site in search of a place to pupate. Many flies can complete development (egg-larva-pupa-adult-egg) in an extremely short time, as little as seven to 14 days, and numerous generations are completed during a typical season.

Although flies are most often a nuisance during the warm season, some flies can be problems as they overwinter in buildings. This latter habit is most common with cluster flies and face flies.

Common domestic flies and their habits include:

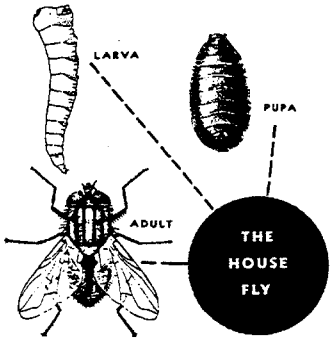
Blow Flies

These are metallic green, blue or black flies that are very common throughout the region.

Blow flies tend to breed most commonly on decaying carcasses and dog droppings. Garbage is also used as food for the maggots. Occasionally, blow-fly maggots are found in homes, wandering off the carcass of a dead rodent or bird that was trapped within the home. Adult blow flies may also be attracted to gas leaks.

House Flies

These are the best-known of the domestic flies. They are generally gray in color, with the thorax marked with broad, dark strips. Often there is some yellow coloring along the sides, differentiating them from the face flies. House flies are intimately associated with humans, and larvae almost always develop in man-made sources of food. These include garbage, animal waste, culled fruits and vegetables, and spilled animal feed. The adult flies feed on a wide range of liquid waste. House flies also can feed on solid foods, such as sugar, by regurgitating and liquefying the food. Because of these habits, house flies can be serious health threats, as they mechanically transmit disease organisms. During mild winters, house flies may continue to fly and breed continuously as temperatures permit.



Face Flies

These are closely related to house flies and are hard to identify. The wide separation of the eyes in the male flies and the absence of yellow coloring can often help distinguish face flies. Although similar in appearance, their habits differ greatly from house flies, and they often are more common than house flies, especially in rural areas. Face flies pass the winter in the adult stage, often seeking shelter in upper stories of buildings, such as attics, steeples, and little-used upper rooms. They

become active in spring, and females lay eggs in fresh bovine manure less than one day old.

Adult flies may feed on many types of fluids. They are often attracted to the exudations around the eyes, nose and mouth of cattle. They have been implicated in transmitting pinkeye disease. Cluster flies are one of the most annoying flies found within homes during the cool seasons. They are also serious pests of office buildings, often concentrating in upper stories. The cluster flies are somewhat larger than house flies, and during the period they spend indoors, they are semi-dormant and fly awkwardly.

Habits of cluster flies are very different from other common domestic flies. Immature stages develop as a parasite of earthworms. Eggs are laid in the soil, and the maggots enter and feed within the earthworms. Cluster flies don't feed on garbage and animal manure. In late summer, cluster files seek overwintering shelter. Late in the afternoon, they often fly to buildings and rest on sun-exposed areas. As the sun sets, the flies creep upwards, ultimately moving to upper stories. They then seek out cracks and other openings into the building. Once inside the building, the cluster flies may occur in large groups.

Fly Control

Sanitation practices that remove breeding areas are fundamental to control filth-breeding flies, such as house flies and blow flies. Garbage should be regularly removed or covered. Spilled animal feed and manure should be cleaned up. However, face flies (that typically develop in pasturelands) and cluster flies (earthworm parasites) are often hard to control with breeding-area management.

Screening and other exclusion techniques can be very important to management of indoor fly problems. All openings into homes should be caulked or covered to prevent flies from entering. Efforts to exclude flies must be done prior to periods when they enter. For example, cluster flies are rarely observed indoors until winter and spring months, but they typically enter during late August and September.

Use of insecticides for fly control should only be considered supplemental to other controls. Serious problems with insecticide-resistant flies are widespread, and many fly populations are now poorly controlled with insecticides. Spot treatments of insecticides applied to areas of high fly-activity are most efficient. For example, insecticide-impregnated resin strips may be used inside garbage cans. Flies that tend to rest in dark corners can be controlled by applications to these areas. Cluster flies are controlled by treatments applied to upper stories of building exteriors immediately before periods when flies move indoors for overwintering.

Several types of traps for flies are also available and can supplement other controls. Flypaper and electrocution light traps can kill flies, but these should only be considered for sites where exclusion and sanitation efforts have reduced the fly populations to low numbers. Various food-based traps are also offered for sale and can supplement other controls.

FUNGUS GNATS

Fungus gnats are small, dark-colored flies that are most often observed collecting around windows, usually during fall and winter. Fungus gnats commonly occur outdoors, where they breed in mushrooms and decaying plant materials. Indoors, fungus gnats infest potting mixes used for house plants. High-organic-matter plant mixtures or use of organic fertilizers, such as fish emulsion, can encourage fungus-gnat development. Over-watering, a common problem during fall and winter, also encourages fungus gnats by increasing fungus development.

Fungus gnats cause little, if any, damage to house plants and are primarily a nuisance problem. Attention to correcting conditions of the breeding area (moist potting soil) is the most effective means of controlling infestations.

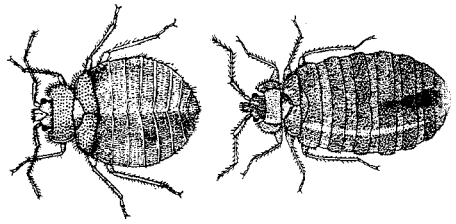
FRUIT FLIES

Fruit flies are among the smallest flies found in homes. They are usually a light-brown color and may be marked with bright red eyes. Most often, they are found hovering around overly ripe fruit or around fermenting materials, such as leftover beer or soft drinks remaining in opened containers. Fruit flies are best controlled by removing breeding sources.

BITING AND STINGING INSECTS

BEDBUGS (*Cimex lectularius*) **AND BAT BUGS** (*Oeciacus vicarius*)

The human bedbug and its relatives form a small group of bloodsucking insects (family Cimicidae). Barn-swallow bugs and poultry bugs *(Haematosiphon inodorus*) also occur. Bat bugs are rare in Utah. Bat bugs and bedbugs are characterized by a short, broad head, broadly attached to the prothorax, and an oval body. The body, as a whole, is broad and flat, enabling the bugs to crawl between narrow crevices. The adults are one-fourth to three-eighths inch long, brown and wingless. After taking a blood meal, bedbugs change enough in size, shape and color so as to make them look like an entirely different insect. The immature stages (nymphs) resemble the adults in shape, but are yellow-white in color.



Bedbug *Bat bug*

The adult female deposits eggs in cracks, crevices, behind woodwork, and in similar locations. Eggs hatch in six to 17 days -- about ten days on average, and newly hatched nymphs will feed as soon as food is available. Environmental factors and food availability will cause variation in developmental rates. Complete development of bedbugs and bat bugs averages 1-1/2 months. Adults can then live for a year or more. The bite of these bugs is often painless, but a toxic saliva injected during the bite will later cause severe itching and a large inflamed area often called a weal. Individuals may vary widely in sensitivity to these bites. This bite can be distinguished from a flea bite by the absence of a red, surrounding halo and the presence of a red central area within the inflamed area.

Bedbugs are moved about from one location to the next mainly on infested furniture and bedding. Bedbugs may also come from other infested homes by way of water pipes, gutters, through windows, along walls, etc. Migrations often occur if a house is vacated and their food supply is cut off. Populations of bat bugs usually develop on nesting bats, birds, or small mammals before invading living areas through cracks and crevices. Typically, bat- bug infestations originate from animal populations established in the attics. Barn-swallow bugs breed freely all summer in swallow nests.

In early autumn, when bird migration occurs, the barn-swallow bugs scatter and invade human dwellings. Poultry bugs develop on poultry and occasionally become very abundant in chicken coops. In homes, problems with barn-swallow bugs, bat bugs, and poultry bugs often are severe for a short period (days or weeks) before dying down, since survival is poor without their natural animal hosts. As an infestation increases, bat bugs and bedbugs will infest other areas of the home, such as in tufts and seams of mattresses and bed covers, under loose wallpaper, in areas behind baseboards, around window casings, beneath floorboards, and in any other suitable crack or crevice.

Indicators of an infestation may also include blood stains on walls and bed linens, excrement spots, and cast skins from immature stages. A "buggy" odor, resembling the smell of fresh red raspberries, is associated with bedbugs but not with bat bugs.

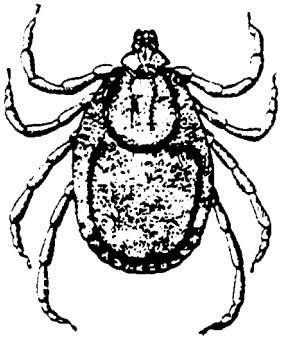
Bedbug and Bat Bug Control

Where bat bugs are a problem, the original site of infestation (roosting areas) should be treated. A total-release aerosol in the attic to supplement residual sprays is helpful. Controls should be concentrated on living areas below the attic by treating cracks and crevices, areas around light fixtures, and any other place the bat- bugs may have used to migrate from the attic. Exclusion and removal of bats and other hosts of the insects in the home should also be made. This last step should be coordinated with insecticide treatments, since an increased movement of bat bugs into the living area may occur after removal of the animals.

Follow up bat-bug and bedbug control with a thorough examination to find hiding places of the insects. Any place offering darkness and protection (such as areas behind baseboards, under loose rugs or wallpaper, and in mattresses) should be checked. Also examine folds

in chairs, beds and couches. Insecticides should be sprayed in areas used by the insects for hiding. In barn-swallow bug control, federal and state laws protect swallows and their nests. Management of these birds and their nests must involve taking these regulations into account.

BROWN DOG-TICK (*Rhipichephalus sanguineus*) Brown dog-tick is a common indoor tick in Utah. Unlike the more common "wood ticks" (*Dermacentor spp*.) that are commonly encountered in hiking, the brown dog-tick is capable of reproducing indoors and in order to increase in numbers. Almost invariably, dogs must be present, on which the ticks feed and reproduce. Humans are rarely bitten by this species.



Brown dog tick (female)

The brown dog-tick is a subtropical and tropical tick that isn't thought capable of overwintering outdoors in Utah. Most infestations originate by direct contacts with infested dogs or during warmer months, when dogs travel through areas previously frequented by an infested dog. Kennels are also an important location of brown dog-tick spread.

The egg stage of the brown dog-tick occurs within a large mass, usually numbering several hundred eggs. Eggs hatch in about two weeks, and the small, six-legged "seed ticks" move about to find dogs or rodents on which to feed. After feeding on the blood of the host animal for a few days, the young ticks drop off and hide in cracks or similar protected areas, usually near where the dog commonly rests. They then shed their skin (molt), this time appearing as a slightly larger eight-legged form. Another feeding cycle is then completed, and the third, adult stage appears.

Adult brown dog-ticks typically feed between the toes, near the ears, or around the anus of the dog. During this final blood-feeding, the ticks may remain attached for one to five weeks. After becoming fully engorged, they drop from the dog. At this time, the ticks may be almost one-third inch in size and bloated. The full-grown ticks often show a strong tendency to climb and often are found climbing walls or hidden in cracks of ceilings and kennel roofs.

The entire life cycle of the brown dog-tick may be completed in as little as two months under favorable conditions. When temperatures are cool or the ticks are unable to find a host for feeding, the life cycle may extend as long as a year.

Brown-Dog-Tick Control

Brown-dog-tick control can be a long, hard project. If the animal is to remain in the infested area, some careful use of insecticides will be required to kill ticks on the animal and in locations where the ticks hide. Several products are registered for use as pet shampoos, sprays or dips to kill ticks present on the animal. It's usually desirable to get the help of a veterinarian for prescription of materials used on pets, since some breeds are especially susceptible to certain insecticide products. Insecticides used on dogs almost invariably mention that they are not to be used on puppies, convalescing or sick dogs, and nursing mother dogs.

Attention must also be given to the areas used by the ticks when molting or laying eggs. Often, these are located near the area where the dog usually rests. Directed insecticide applications to these areas with residual insecticide sprays can be effective for this use. Removal of dogs from infested homes will eventually cause infestations to die out. However, ticks can survive for six to eight months without feeding, and reinfestations are possible at any time during this period, if susceptible host animals are present.

FLEAS

Pets such as dogs and cats and wildlife, especially ground-dwelling rodents, can occasionally develop seriously annoying infestations of fleas. Fortunately, problems in Utah are less frequent than in more humid areas of the country and are usually of short duration.

However, a more serious concern in some areas of the state is the ability of fleas to transmit bubonic plague.

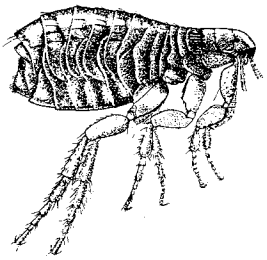
Flea bites to humans appear as itchy, red spots usually surrounded by a red halo. Bites often occur in clusters, especially at the edges of tight-fitting clothing. Some individuals are extremely sensitive to flea bites, while others are fairly immune. Humans are not a favored host of fleas, and most bites occur when the fleas are starved, such as following a long absence of a pet.

Adult fleas are small (one-thirteenth to one-eighteenth inch long), reddish-brown, flattened insects. They are wingless but can jump. It's the adult stage that feeds on blood.

Flea eggs are usually laid around areas used often by pets. The eggs hatch, and a wormlike larval stage follows. It feeds on organic matter such as hair, skin flakes, or blood excreted by the adult fleas. Several months are required for the larvae to complete development, with low humidity prolonging development.

Flea Control

Flea-control measures should be directed at all stages of the fleas' life cycle. Controls of the egg and larval stages include washing pet blankets and bedding, and thoroughly cleaning any areas where pet hair accumulates. Larval control can further involve use of insecticides applied to cracks and crevices around where the pet lives. Among the more effective chemicals are newer insecticides that affect flea growth (insect growth-regulators).



Adult flea

Adult fleas on the pets can be controlled by use of shampoos, flea powders, and flea-and-tick collars. However, insecticide-resistant strains of fleas occur that may not be easily controlled.

In areas where wild rodents harbor fleas that may carry the plaque disease organism, control involves dusting of rodent burrows. Rodents such as ground squirrels and rock squirrels that have died suddenly may indicate plaque outbreaks. Suspected plaque incidents should be reported to the Utah Department of Public Health, Epidemiology, 801-538-6191.

WASPS AND BEES

Several different wasps and bees occur in Utah, and the great majority have highly beneficial habits. Bees, such as the honeybee and leafcutter bee, are essential to the pollination of many crops and native plants. Most wasps are predators of pest insects, feeding insects to their developing young. Problems with wasps and bees occur when nests are located near high-traffic areas or in buildings. Also, late-summer foraging by yellow-jacket wasps can be a serious nuisance problem for outdoor restaurants and other areas where food is served outdoors. Also, wasps may enter homes and buildings during fall in search of overwintering shelter.

Social Wasps

Almost all nuisance problems involve people's homes and the social wasps, including the yellow jackets. These insects annually produce new colonies that are built of paper. Those produced by yellow jackets are usually made underground or in wall voids. Bald-face hornets make large aerial nests in trees, especially maple trees. Fertilized females overwinter in protected areas, including homes, and begin to build nests in the spring. As the season progresses, more worker wasps are present to help with colony development, and nests rapidly increase in size. By late summer, each colony may have hundreds of wasps. At this time, the colony starts to break up, with many of the large females leaving.

Following several hard frosts, the nests are completely abandoned. Nests are not reused the following year. Social wasps feed their young protein-rich foods, mainly insects. Late in the season, food preferences switch to include more sugary materials, and they are attracted to soft drinks, syrup, and other materials. During this period, they can be extremely annoying. Almost all "bee" stings actually involve social wasps such as yellow jackets.

Wasp Control

Destruction of wasp colonies is fairly easy if the nest can be located. Insecticide dusts are usually most effective for ground-nesting yellow jackets, since they are more readily tracked into the colony. Aerial nests are best controlled with use of directed sprays forced into the opening. Often it's best to combine a fast-acting "knockdown" insecticide, such as pyrethrins or resmethrin, with a more persistent insecticide. Colonies often are not completely killed for at least a week after application, since developing wasps remaining in rearing cells continue to emerge for several days. It's safest to control wasps very early in the morning or in the evening, when their activity is reduced.

Light-colored clothing and protective clothing is recommended to avoid stings. In many cases, it's best to wait out wasp infestations. Since colonies are abandoned at the end of the season, problems can be resolved without treatment, if the colony isn't causing too much of a nuisance problem.

Solitary Wasps

Several wasps don't produce a social colony, instead individually rearing their young in nests of mud or in tunnels underground. These are hunting wasps that collect spiders, cicadas, caterpillars, and other prey for their young. Many are highly beneficial. Although the solitary wasps sometimes appear rather fearsome, they rarely sting, and their sting is less painful than the social wasps. If necessary, colonies of mud-nesting species can be controlled simply by pulling down nests. Residual insecticide sprays can also prevent wasps from nesting.

Honeybees

Unlike the social wasps, honeybees form a semipermanent colony. Nests are constructed of wax, and most colonies are maintained by beekeepers. Honeybees feed on nectar and pollen, which they feed their young and use to produce products such as honey and beeswax. Honeybees also may collect water to cool the hive and plant-sap to help seal cracks.

Honeybee

Yellow jacket

Periodically, overcrowded colonies form swarms that leave the hive. The swarms rest temporarily on a tree or shrub while scout bees search for a nesting cavity. Although the swarms are very striking, the bees are very docile at this time. Most beekeepers are willing to collect honeybees in a swarm. Problems with honeybees occur when swarming bees find a building-wall opening and construct nests in buildings. These nests can sometimes get to be very large over the course of several years, and their removal becomes difficult. Although colonies can be relatively easily killed with insecticides, the wax, honeybee debris, and other hive debris remain behind. The wax can melt with high temperatures, and old colonies attract rodents and other pests. As a result, the old colony must be removed, which can require tearing out parts of the wall.

Ground-Nesting Bees

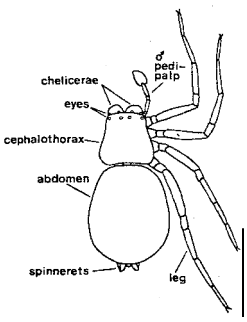
In several areas of the state, occasional problems occur with ground-nesting bees. These are solitary bees that individually rear their young within cells underground. However, certain sites with a sunny exposure and proper soil type and cover are highly preferred. Sometimes, hundreds of bees may nest at such a site near each other.

The solitary bees are non-aggressive and rarely sting. They are best controlled by somehow changing the surface of the nesting site by such techniques as sodding, covering with straw or other organic materials, or incorporating different soils. This will allow a permanent solution, since nesting will move to another area if nest conditions are unsatisfactory.

SPIDERS

Spiders are a group of animals classified as arachnids. They are not insects, instead being more closely related

to mites and ticks. Spiders are characterized by having eight legs and two distinct body regions (cephalothorax and abdomen).



All spiders feed only on insects and other small arthropods. Their activities are highly beneficial, since they help control many pest species in yards and in and around homes. Unfortunately, there is a widespread -- and largely unfounded -- fear of spiders by most people.

Spider fears also exist because a few poisonous species occur, such as the black widow. Many spider species occur throughout Utah. They begin life as eggs laid in egg sacs that are bound by silk. These eggs sacks may be guarded or even carried by the female. The young spiders (spiderlings) emerge from the eggs and scatter. Many spiders disperse by "ballooning." This occurs by spiders producing silken threads that are caught by the wind. Although they don't have wings, spiderlings have been known to be carried hundreds of miles on wind currents. The developing spiders feed and grow over a period of several months. During this period, they molt several times before becoming full-grown. Many common spiders have one generation per year and become full-grown in late summer. However, habits vary, and mating and egg-laying can occur during almost any time during the year, depending on the species.

All spiders can produce silk. Many of the more conspicuous species use silk to help build webs used to capture prey. Many other spiders don't produce a web, but instead hunt their prey. These hunting (or ambush) spiders use their silk only for building egg sacs or retreats. Spiders eat live prey. Victims are killed by a venom that the spider injects through fangs.

However, spiders may survive for months without food. Most species of spiders found in homes are attracted to water sources, if they are available. Areas around water pipes, floor drains, and plumbing fixtures and in air conditioners are common areas spiders will infest while in a home. However, some spiders prefer warm, dry, undisturbed sites and can be found in subfloor air vents or upper corners of rooms. Spiders found indoors often hide in cracks, darkened areas, or silken retreats they have built.

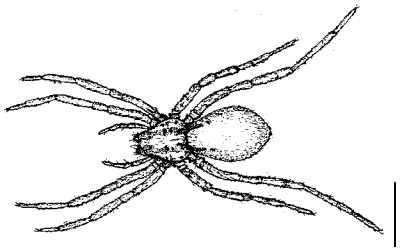
Movement of spiders into homes greatly accelerates after cool weather arrives in early fall. Also, male spiders of most species are often highly mobile and range widely while searching for mates. Many of these spiders fail to survive for long in homes, but periodically they can be very numerous.

Spider Bites

Although all spiders bite and produce a venom, few pose any health threat. The venom of most spiders isn't very toxic to humans, and many smaller spiders can't break the skin. Also, spiders are not usually aggressive and only bite when accidentally handled or trapped. Two poisonous species of spiders do occur in Utah, the black widow and the hobo spider. The habits of these species and symptoms of their bites should be recognized.

Common Utah Spiders

Wolf spiders are fairly large hunting spiders that often cause alarm because of their appearance. Most are gray or brown and fast-moving. Many species exist, and most are about one-half inch long. However, one genus of wolf spiders, the giant burrowing spider, may be 1-1/2 inches. Wolf spiders most commonly enter homes late in the season. They hide in cracks and don't produce webbing. Larger species can produce a mildly painful bite, but symptoms don't last long.



Wolf spider

Jumping spiders are brightly colored, active spiders. Their bodies are often densely covered with colored hairs, and some may appear iridescent. They have a

stout body and large eyes. They are active during the day and may jump or move sideways with ease. They rarely reproduce in homes, and most occur as late-season invaders after frosts.

Orb weavers produce characteristic large webs that have radiating threads from a central point. Some of the orb weavers become quite large, such as the common garden argiopes and the "monkey-faced" or "cat-faced" spiders. They rarely enter homes, but they attract attention because of their conspicuous size and web.

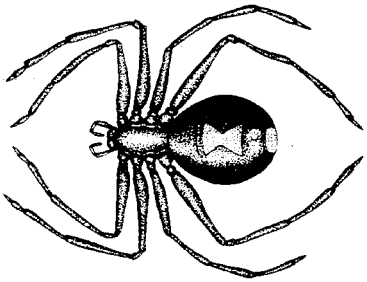
Funnel-weavers are medium-sized spiders varying from one-eighth to three-fourths inch in length. Their funnel webs are easily seen on lawns in late summer. Funnel-weavers may also inhabit corners of cellars or outbuildings. Egg sacs are often laid in a cocoon that remains attached to the web.

Cobweb spiders are very common in homes, and many are well-adapted to survival indoors if enough prey is present. These are small to medium-sized spiders that typically are found hanging upside down from irregular webs in corners of rooms and other darkened areas. When prey is tangled in the web, they throw anchoring silk strands over it. They don't completely wrap the prey, as do the orb weavers. Although almost all cobweb-weavers are harmless, the black widows also belong to this family of spiders.

POISONOUS SPIDERS

Black Widow

The black widow is a common species in many parts of Utah. Black widows produce a loose web and prefer to inhabit dark, undisturbed areas. Typical locations of black-widow nests include locations such as shrubbery, around log piles, in crawl spaces, under porches, in garages, and around piled debris.



Black widow

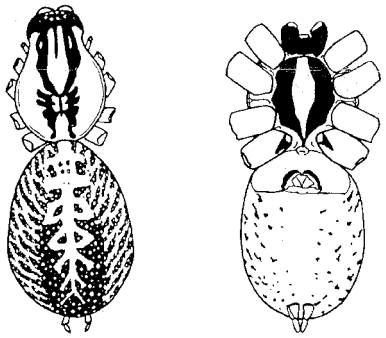
Essentially, all human bites occur from the female, often as she is guarding her egg sack. The full-grown female is about one-half inch long and shiny black or dark brown. It has a spherical abdomen. Most black widows also have orange-red markings on the underside of the abdomen, sometimes appearing as an hourglass. However, these markings may be reduced and even absent among many of the black widows. The venom of the black widow spider is a nerve poison that produces distinctive symptoms. Often the original bite isn't very painful, but it may be followed by a burning sensation, local swelling and redness. Pain may become intense in one to three hours and last up to 48 hours. Cramping of the legs, arms and chest may follow. The abdominal muscles become rigid in many cases.

Black-widow bites should receive prompt medical attention. Although fatalities are very rare, symptoms are very painful. Antiserums are available, and injections of calcium gluconate can help to relieve symptoms. Whenever possible, try to bring the spider to the doctor to confirm the diagnosis and help with proper treatment.

The Aggressive House Spider (Hobo Spider)

The aggressive house spider or hobo spider, *Tegenaria agrestis*, was first identified in Utah in 1990. Its current distribution indicates that it has probably been here for several years longer than that. The aggressive house spider is of importance because of its ability to cause necrotic spider bites similar to those of the brown recluse spider.

The aggressive house spider builds funnel or tube-shaped webs. It's a long-legged and swift-running spider. It has a brown cephalothorax and brown legs. The abdomen has a distinctive pattern of yellowish markings on a grayish background, although this pattern may be hard to see without a microscope.



Dorsal markings (left) and ventral markings of the Tegenaria agrestis.

The complete life cycle of the aggressive house spider lasts for two years. Aggressive house spiders prefer to use habitats that have holes or cracks to support their funnel-like webs. They are poor climbers and are rarely seen above ground level.

Aggressive house spiders are most commonly encountered from June through September, when males wander in search of females. For this reason, most bites occur during July through September. Males generally have a more toxic bite than females, while immatures seem to cause the most serious bites. Females of the species tend to stay in their webs and are not usually found running about.

The aggressive house spider is medically important because of its ability to cause necrotic spider bites. Necrotic spider bites have been reported in Utah for many years and are usually blamed on the brown recluse spider. However, no specimens of the brown recluse spider have ever been documented in Utah.

The bite of the aggressive house spider is relatively painless and is reported to feel like a pin prick. Within fifteen minutes of the bite, numbing sensations may occur at the bite site and other areas of the body, and dizziness may occur. After about one hour, reddening around the bite begins and enlarges in area. The bite site becomes hardened and swollen within about 18 hours. Blistering at the bite, severe headache, visual or auditory disturbances, weakness, and joint pains may occur within the first 36 hours.

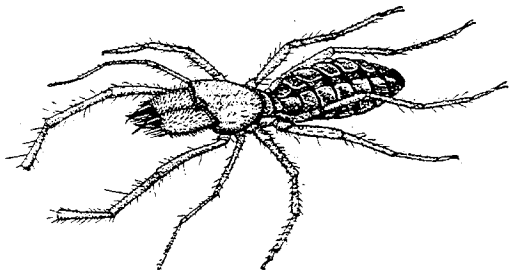
Within 24 to 36 hours, a discharge of fluids and blistering may occur, and after two or three days, the area around the wound may blacken. After seven to ten days, the necrotic area will usually take on a characteristic elliptical shape. Spells of nausea and sweating often persist through this time period, and headaches may persist even longer.

If you suspect you've been bitten by an aggressive house spider, you should seek immediate medical attention. The treatment for any necrotic spider bite is similar.

Control methods for the aggressive house spider are most effective if they use a combination of methods, including habitat elimination, exclusion, avoidance of risk, and chemical control.

Sun Spiders

Sun spiders (solpugids or wind scorpions) are another group of arachnids distinct from the true spiders. Sun spiders are yellowish-brown and larger than most spiders. They are most easily identified by their very long pair of pedipalps on the sides of the head, which superficially appear as a fifth pair of legs. Sun spiders also have a pair of greatly enlarged jaws.



Sun spider

Sun spiders are common throughout much of Utah. They are active hunters of other arthropods and usually feed at night, hiding under rocks and debris during the day.

Occasionally, sun spiders enter homes. Because of their large size and aggressive appearance, they typically cause alarm. However, they seldom bite, unless handled or crushed inadvertently. The bite can be painful, but the pain isn't very persistent. Sun-spider movements into homes can be discouraged by keeping shelter materials (rocks, debris, etc.) away from the

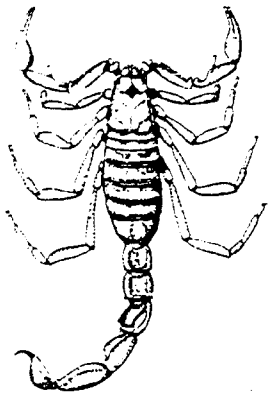
foundation. Foundation perimeter applications of insecticides can further improve control. However, sun-spider abundance in homes is usually very low, with most incidents involving isolated sun spiders.

Scorpions

Scorpions are a distinctive and well-recognized group of arachnids. They are most easily distinguished by their lobster-like appearance, but especially by their flesh "tail" that terminates in a bulbous sack and prominent stinger. The larger front pincers (a modified mouthpart) are used to capture and hold prey while feeding. The stinger is used to subdue prey and for defense.

Scorpions are not common, but they can be found in Utah. They are most commonly encountered by people working around rocks or debris, which are hiding areas for scorpions during the day. Rarely, scorpions may enter homes. Entrance into homes occurs most commonly in newly developed areas less than three years old. Often, migrations into homes follow heavy summer rains.

Scorpions can produce a painful sting when handled or accidentally disturbed. Fortunately, local species are not considered to be highly poisonous.



Scorpion

Scorpions have a life cycle of two to five years. They don't lay eggs; the female bears live young seven to 12 months after mating. A female may produce litters of about 14 to as many as 100, and the young are carried on the back of the mother until they have molted. Immature scorpions then leave the mother and become mature in about one year.

Scorpions spend the daytime under cover or in burrows in the ground. At night, they emerge to defend their territory and to feed. Since scorpions have poor eyesight, they don't stalk their prey; instead, they lie in wait for ambush. Insects, spiders, millipedes, and small vertebrates are common scorpion prey.

Scorpion Control

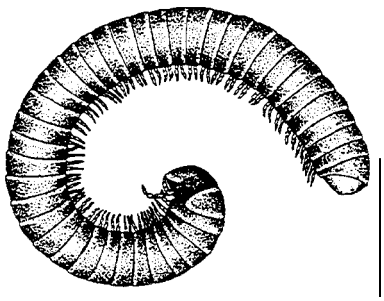
During dry weather, scorpions are attracted to moisture. Because of this habit, they may be trapped by spreading wet burlap bags and collecting the scorpions during the day. Scorpions can also be discouraged from areas around homes by removing potential cover, such as stones, lumber, and other debris. Sealing entrances into homes can also exclude scorpions. Scorpions fluoresce brightly when exposed to ultraviolet (UV or black) lighting. They may be easily spotted for capture from several yards away using this technique.

Outdoor applications of residual insecticides can increase scorpion control. Applications should be directed to harborage areas, such as stone piles. It isn't necessary to treat grass lawns. Exterior foundation treatments can also help provide additional control.

NUISANCE HOUSEHOLD INVADERS

MILLIPEDES

Millipedes are a common arthropod found around Utah yards and gardens. Typically, the millipedes are dark brown and wormlike. On close inspection, they can be seen to have numerous small legs.



Millipede

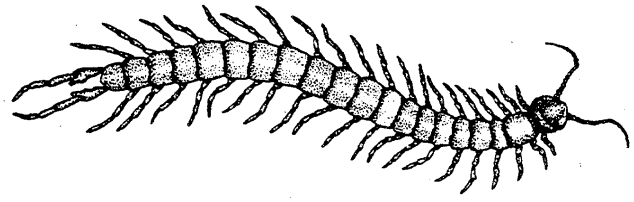
Millipedes feed on decaying plant materials and thrive in moist areas such as lawns. Occasionally they will move into homes, sometimes in very large numbers. However, the arid climate of Utah homes almost always kills the millipedes within a day or two. After

dying, the hardened, curled body of the millipede may persist for a long period.

Millipede movements into homes typically occur during spring or fall, shortly after a period of rainfall. Household migrations can be reduced by eliminating sheltering debris around the foundation, sealing openings, and using insecticides around the foundation exterior.

CENTIPEDES

Centipedes are arthropods that are marked by having a single pair of legs per body segment. They are general flattened and elongate in form. Centipedes are quite fast-moving and are predators of insects and other arthropods.

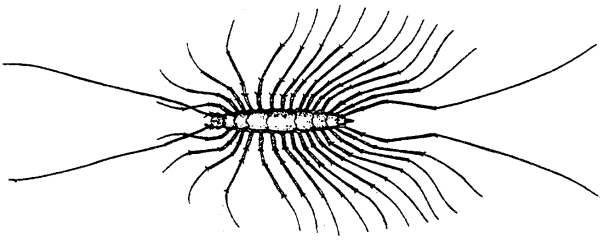


Centipede

Most Utah centipedes rarely invade homes, mostly staying outdoors under cover during the day. Occasionally, individuals of the large (four to six inches long) desert centipede are found indoors and cause alarm. However, like most centipedes, the desert centipede has shy habits and avoids light. Although it's capable of producing a painful bite, this is extremely uncommon and only occurs when they are accidentally crushed or handled. Household invasions of centipedes are usually self-limiting, since they don't reproduce or survive long in most homes.

House Centipede

An exception is the house centipede, a species that seems to be better at colonizing homes. Legs of the house centipede are very long, and it can crawl and climb fast. House centipedes survive in low numbers in many homes as long as live prey (insects, spiders, etc.) is available in the home.



House centipede

Centipede movements into homes can be reduced by removing sheltering debris from around homes and by use of perimeter pesticide applications around building foundations.

ARMY CUTWORM

Army cutworm is one of the most common nuisance moths in Utah. Army-cutworm moths can be extremely annoying during late spring, as they enter homes, cars and buildings. However, army cutworms don't breed and reproduce indoors, and they will naturally die out within a few days.

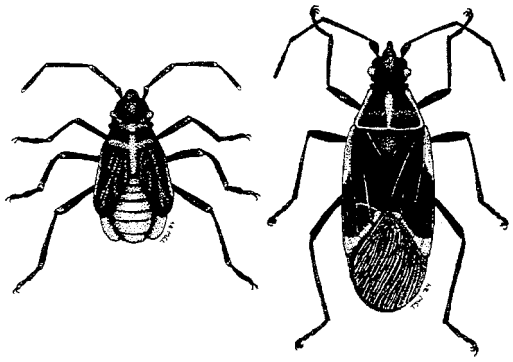
Army Cutworm Control

Insecticides work poorly for control of "miller moths," and preventive steps should be taken to minimize problems. Openings around doors and windows should be sealed during the periods when flights are greatest. Evening lighting should be reduced, since that attracts the moths.

Moths in the home can be individually vacuumed. Moths can also be trapped by suspending a light over a bucket of soapy water. Problems with the moths naturally end as the migration flights cease. However, this may take several weeks.

BOX ELDER BUGS

Box elder bugs often become serious nuisance pests as they move into homes for shelter during fall. Problems are most severe along south and west sides of a home, since the bugs tend to move into cracks and crevices in these sun-warmed areas.



Immature *Adult*

Adult box elder bugs are about one-half inch long, dark brown or black, with conspicuous red markings. Immature box elder bugs are smaller and a solid, bright red color. Only the adults are capable of overwintering successfully.

The box elder bug develops during the warm months on seeds and other plant materials. The first generation usually feeds on seeds fallen from trees the previous year; box elder seeds produced on female box elder trees are the food of the second generation. Severity of box elder bugs as nuisance-pests are correlated with such factors as amount of seeds produced the previous year, nearness of female box elder trees, and length of the growing season.

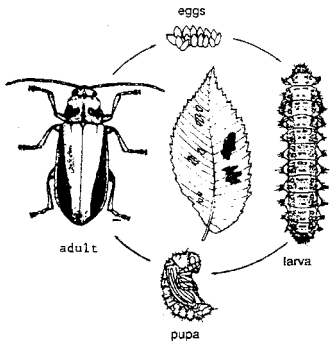
Within a home, box elder bugs are in a semi-dormant state. They can't reproduce and don't feed on household items. Bites on humans are rare, but occasionally they occur.

LEAF-FOOTED BUGS

The leaf-footed bugs (family Coreidae) develop on a wide variety of seeds, such as dogwood and pines. Populations are greatest in areas of conifer forest, and this insect is common in many mountain areas. Similar to the box elder bug, leaf-footed bugs often migrate into homes during late summer in search of overwintering shelter.

ELM-LEAF BEETLES

Elm-leaf beetles are very common pests of elm trees, especially Siberian elm. Larvae (grubs) are mottled with black or dark brown, and they feed on elm leaves. Damage to the leaves is characteristic, called skeletonizing, since the beetles typically feed between the larger leaf veins. Adult beetles also feed on the leaves, usually chewing small holes. Typically, there are two to three generations of the beetle during a growing season.

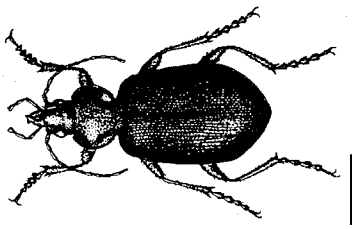


Life stages of the elm leaf beetle

At the end of the year, adult beetles move to overwintering shelters. Houses, sheds, log piles, and other areas are common overwintering sites. Elm-leaf beetles that use homes for shelter often migrate into the living space, where they are a nuisance. As with most overwintering insects, activity of elm-leaf beetles is largely suspended during the coldest months. As temperatures warm during the spring, increasing numbers become active and emerge from overwintering sites. However, the entire period spent in homes involves non-feeding stages, which don't reproduce. Infestations detected during spring are related to the numbers of beetles that moved into the dwelling for hibernation during fall.

GROUND BEETLES

Ground beetles are one of the most easily recognized and beneficial groups of insects. They are commonly seen outdoors, under logs or debris, running quickly for cover when disturbed. Hundreds of species occur, in a wide range of sizes (one-eighth to one inch long) and colors (black, brown, metallic green, etc.).

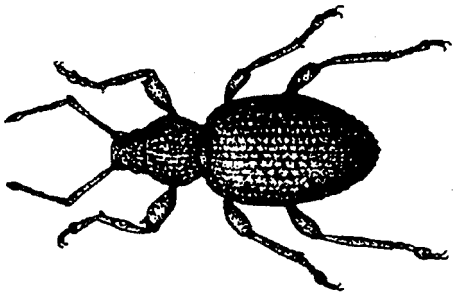


Ground beetle

Ground beetles are predators of other insects, such as cutworms and other pests that occur in or on the soil. However, ground beetles may invade homes through windows, doors, or cracks around the foundation. This is especially common following rains or during other high-moisture periods that force them to move. Within homes, ground beetles are harmless and won't bite humans or feed on household materials.

ROOT WEEVILS

Several species of root weevils occur in Utah. Larval stages of these insects feed on the roots of a wide range of plants, including berries, Douglas fir, and many ornamental shrubs. One root-weevil species, the black vine weevil, is a serious pest of several landscape plants, such as euonymus and taxus.

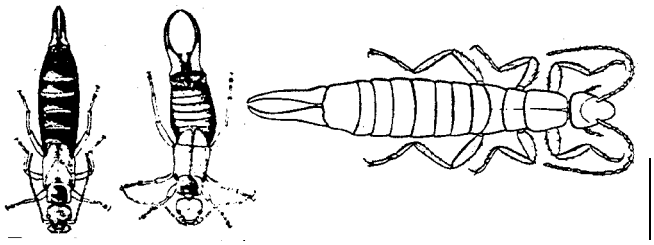


Root weevil

Adult root weevils are a common nuisance-invader of buildings during summer. Problems are especially common in mountain areas of the state. Although they don't damage household furnishings, they can be very abundant and persist for several months.

EARWIGS

Earwigs are infrequent invaders of Utah homes. Nocturnal feeders, earwigs seek dark, tight areas for daytime shelter. This often forces them into cracks and crevices around homes, from where they may enter living areas.

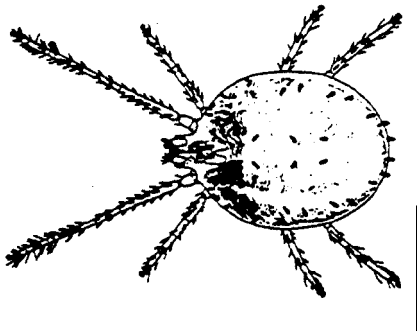


Earwigs

Earwigs are general feeders. Occasionally, they feed on tender plant parts, and they can damage certain flowers, such as dahlias and roses. However, earwigs mostly feed on small, soft-bodied insects such as aphids. Reducing the amount of sheltering debris around the foundation area is important in limiting earwig movements into homes. Residual insecticide sprays applied around the building foundation can also help reduce indoor earwig populations. Most problems with earwigs in homes occur during mid- to late summer.

CLOVER MITES

Clover mites are small, red-green mites that move to homes from surrounding areas of lawn and other vegetation. Unlike most other species of spider mites, the clover mite is a cool-season spider mite that is most active during spring and fall. During these periods, clover mites use walls for egg-laying and may seek shelter in building cracks. Many of the mites may inadvertently enter living areas during these activity periods.



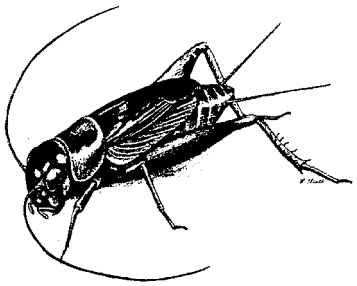
Clover mite

When in homes, clover mites are often described as "walking dust specks." When crushed, they leave a rusty stain. Infestations of clover mites are usually confined to the sun-exposed (south and west) sides of buildings. They are most severe during late winter and early spring. Since mites don't readily cross loose, clean, cultivated soil, an unplanted border around the building can help prevent indoor migrations. Spot treatment with miticides on or along the foundation walls can further help control clover-mite migrations.

CRICKETS

Crickets are relatively infrequent invaders of Utah homes and rarely cause significant damage. Occasionally they feed on fabrics and paper, but cricket

populations are rarely large enough to cause serious damage. However, their chirping "songs" (produced by rubbing the outer wings) can make them very annoying in some situations.
Most cricket problems in homes occur as a result of outdoor populations moving inside.



Cricket

Favorable cricket habitat around the foundation (such as plant debris, tall grass and mulch) can contribute to the severity of cricket invasions, which usually occur in the fall. Crickets may also move into homes while attracted to evening lights. Perimeter treatments with insecticides can reduce cricket movement into homes.

DOMESTIC (Commensal) RODENTS

Domestic (commensal) rodents have coexisted with man in his habitats for centuries. They have eaten man's food and wastes and have shared his living quarters. They have become man's chief vertebrate pest because of their great reproductive capacity and their ability to adapt to new environments. Aside from eating man's food, the domestic rodents are involved in contamination of foods by defecation, destruction of building structures by their gnawing habits, and transmitting diseases and harboring parasites of medical and veterinary importance. Some of the diseases that rodents are directly or indirectly involved in conveying to man are plague, murine typhus, infectious jaundice, ratbite fever, food poisoning, poliomyelitis and rabies.

The three main domestic rodents found in Utah are the Norway rat, the house mouse, and the deer mouse. The roof rat is common in other regions, and a brief discussion of it is also included.

NORWAY RAT

The Norway rat is the common domestic rat in Utah. It has coarse hair and close-set ears, and its muzzle is blunt. Its tail is dark on the top and light on the underneath side. The tail is shorter than the combined length of the head and body. The fur is gray-brown on the back and gray-white on the belly. The adults weigh between 12 and 20 ounces and are 7.5 to ten inches in head-and-body length. The tail length is between six and 8.5 inches. The feces are capsule-shaped and about three-fourths inch long.

Norway rats can be found in warehouses, farm buildings, houses, sewers, rubbish, dumps, woodpiles, and building foundations. They are good climbers. On their hind legs, they can reach a height of 18 inches, and they can jump 24 inches vertically. Rats are good swimmers and stay afloat for 72 hours. The Norway rat has relatively poor vision but keen senses of smell, touch, taste and hearing. The sense of touch is served by long whiskers on the snout. (Domestic rats and mice run close beside a wall where these sensory hairs touch to give the animals information about their surroundings.) The home range is often 100 to 200 feet.

Norway rats and other domestic rodents are mainly nocturnal, but they may go about in undisturbed places during the day. They feed on virtually anything edible. Norway rats are unable to vomit. They must drink water to survive.

ROOF RAT

The roof rat is smaller than the Norway rat. Serious pest populations of roof rats are confined along the southern and western coastal areas of the country. Roof rats have large, membranous ears and a sharply-pointed muzzle. The unicolored tail is usually longer than the head and body combined. The adult head-and-body length is between six and 8-1/2 inches, while the tail ranges between seven and ten inches in length.

The adult weighs from eight to ten ounces. The feces differ from those of the Norway rat in that they are about one-half-inch long and are spindle-shaped.

HOUSE MOUSE

The most common household rodent is the house mouse. This mouse resembles the roof rat in that they

both have large ears, pointed muzzles, and slender bodies. However, the house mouse is a great deal smaller. The tail is unicolored, has little hair, and is about as long as the head and body combined. The adult mouse can be distinguished from a young roof rat because the head and feet of the mouse are distinctly smaller in proportion to its body size. Adults weight one-half to three-fourths ounce and are 2-1/2 to 3-1/2 inches long in head-and-body length. The tail measures between three and four inches long. The feces are one-eighth to one-fourth inch long and are rod- shaped.

Although house mice are commonly found living in man-made structures, they are also well adapted to living outdoors. They are common inhabitants of grassy fields and cultivated grain crops. These wild populations often move into buildings when weather becomes severe. The house mouse has poor vision and is colorblind. However, the mice have keen senses of smell, taste, hearing and touch.

Mice use their sense of smell to locate food items and recognize other individual mice. More research is needed on the value of repellent and attractant odors, but taste appears able to override most odor effects. House mice have acute hearing. They readily respond to unusual noises as a means of detecting and escaping danger. However, house mice become accustomed to repetitive, ordinary noises, and, as a result, their activities may be more visible than those of rats.

An important sensory factor is touch. Mice use their long, sensitive whiskers on the nose and above the eyes as tactile sensors. The whiskers and guard hairs enable the mice to travel easily in the dark, along runways close to walls. House mice feed on a wide range of foods, although cereals seem preferred over other items. In particular, the germ of grains is favored by most mice. As supplemental diet items, mice often show preference for foods high in fat and protein, such as lard, butter, nuts, and dried meats. House mice are sporadic feeders, nibbling bits of food in various locations throughout their range.

Small amounts of food often are taken many times at many places. Mice have two main feeding periods, at dusk and just about dawn. Because of their small size, mice must feed several times during a 24-hour period. This means that they will be active day and night. Their range is normally ten to 30 feed from the nest. Their nest is lined with soft materials such as cotton or paper and may be built in walls, cabinets, upholstered furniture, or other convenient spaces. Their urine and droppings mark the trail for others. Mice are poor swimmers.

DEER MOUSE

The native deer (white-footed) mouse occasionally invades buildings adjacent to fields or woodlands. Deer mice are about the same size or slightly larger than house mice. Deer mice can be differentiated from house mice by a distinct, bicolored tail (upper portion brown-gray, lower
half white). Deer mice characteristically have small ears and eyes and a relatively short tail.

The deer mouse is the most common host of the Hantavirus, but other small animals may carry the disease. Hantavirus is a viral illness transmitted from saliva, stool or urine of infected animals. Once these waste products dry, the virus can become airborne. Infection usually results when the virus is inhaled. The illness is described as a severe respiratory illness that results in death for about 50 percent of its victims.

Use extreme caution or avoid activities associated with exposure to mouse or small-animal droppings.

DETERMINING RODENT PRESENCE

Rodents provide numerous signs that indicate their presence. These include:

Sounds -- Gnawing, clawing, climbing in the attic, and various squeaks are commonly associated with house mice and rats.

Droppings -- Droppings are left along runways, near shelters, and in other places that rodents frequent. Droppings of mice are smaller and usually harder than those produced by rats. However, insects and other rodents may produce similar droppings.

Urine -- House mice urinate at intervals along well-used runways. Occasionally, they also will form small mounds (urinating pillars) that consist of a combination of grease, urine and dirt. Wet and dry rodent urine stains will fluoresce under ultraviolet (black) light.

Smudge marks -- Dirt and oil from the fur of the rodent may sometimes leave smudge marks on pipes and beams. Smudge marks left by rats are much more conspicuous than those produced by house mice.

Gnawing marks -- Wood chips about the consistency of coarse sawdust are produced by the gnawing of house mice. Most gnawing occurs around baseboards, doors, windows and frames, and kitchen cabinets. Recent gnawings on wood are light in color, darkening with age. The size of the tooth marks left in the wood can help distinguish the presence of rats or mice.

Pet excitement -- Pawing and excitement of cats and dogs can indicate the presence of rodents. Pets respond most commonly when the premise has been invaded only recently.

Odors -- Rodents produce characteristic odors. With experience, the musky scent of house mice can be differ-entiated from those produced by rats.

ESTIMATING RODENT POPULATIONS

There's no easy or certain way of estimating rodent numbers. The techniques used most often are "reading" of signs, actual observations of rodent activity, or census of feeding. However, after considerable experience, a rat-control worker can usually detect the presence of rodents, even in fairly low numbers.

Rat sign can provide a very rough estimate of density. After a thorough search for rat sign in attics, basements, around foundations, and behind stored materials, use the following criteria:

Rat-free or low infestation -- No sign. Probably invaded by rats only recently, or the habitat won't support many.

Medium population -- Old droppings and gnawing common, one or more rats seen by flashlight at night. No rats reported observed during the day. There are probably ten rats or more in each general areas where one rat is seen at night.

High population -- Fresh droppings, tracks, and gnawing present; three or more rats are seen at night. Rats are seen in daylight.

PHYSICAL CAPABILITIES OF COMMON COMMENSAL RODENTS

The Norway rat can:

- Gain entrance through any opening that is larger than one-half inch square.
- Climb both horizontal and vertical wires.
- Climb the inside of vertical pipes that are 1-1/2 to four inches in diameter.
- Climb the outside of vertical pipes and conduits up to three inches in diameter.
- Crawl horizontally on any type of pipe or conduit.
- Jump vertically as much as 36 inches.
- Jump horizontally 48 inches on a flat surface.
- Jump horizontally at least eight feet from an elevation of 15 feet.
- Drop 50 feet without being seriously injured.
- Burrow vertically in earth to a depth of four feet.
- Climb brick or other rough exterior walls that offer footholds.
- Climb vines, shrubs and trees or travel along telephone or power lines.
- Swim as far as one-half mile in open water, dive through water plumbing, and travel in sewer lines.
- Gnaw through a wide variety of materials, including lead sheeting, sun-dried adobe brick, cinder block, and aluminum sheeting.

The house mouse can:

- Gain entrance through openings slightly larger than one-fourth inch in diameter.
- Jump 12 inches from a flat surface.
- Jump against a wall or vertical surface and use it as a springboard to gain additional height.
- Jump from a height of eight feet without injury.
- Run up almost any rough vertical surface, including brick walls, wood, weathered sheet metal, wire mesh and cables.
- Run horizontally along insulated electrical wires and small ropes.
- Travel upside down along one-fourth-inch hardware mesh.
- Swim capably, if it needs to. House mice don't tend to dive below the surface, as do rats.

RODENT CONTROL

Rodent control may involve the use of several control measures, including cleanup or sanitation,

rodent-proofing, use of toxicants and traps, and other methods. Sanitation is important in a successful rodent-control program. The elimination of shelter, food and water can mean the difference between success or failure in controlling rodents. Good housekeeping practices are important. A program of routine cleaning should be set up and followed. Such areas as obscure corners, shelves, under and in cabinets, work tables, lockers and equipment shouldn't be overlooked. Eliminate rubbish piles. Keep refuse in rat-proof containers until it's removed.

Rodents need a safe place to hide. Inspect the building to identify potential harborages. Rodent-proofing within the building in such places as stairways, cabinets, lockers, machinery, double walls, false ceilings and floors, boxed-in pipes and conduits may be needed. These sites not only serve as shelter but also as nesting and breeding sites.

Proper storage practices are necessary to eliminate harborages. Rodent damage to stored materials can be greatly reduced if good storage practices are followed. In commercial storage areas, products should be on pallets at least eight inches off the floor, 18 inches from adjacent walls, not stacked more than six feet wide, and separated by an aisle at least 12 inches wide.

These practices reduce harborage areas, permit inspection and cleaning, and allow for installation of appropriate control measures. Outside, keep grass, weeds, and other vegetation near buildings closely cut. Eliminate lumber, rock piles, rubbish, and old equipment. Fill in old rat holes and burrows with earth. Store items at least 18 inches off the ground and away from walls or fences. Rodent-proofing involves the removal of all possible entrances into buildings. Exclusion practices are often hard because of the habits and behaviors of rodents. Rats and mice are quite agile and capable of entering through extremely small openings. Openings of one-fourth to one-half inch are big enough for mice and rats respectively. Rats can enter building through drains and toilets. Both rats and mice are capable of gnawing through wood, fiberboard, and many plastics. Exclusion or rodent-proofing is hard, but it can be achieved through modification of existing buildings or in the design of new buildings. In pest-control work, it isn't always possible to do extensive rodent-proofing; however, you should see that some is done so your control program will have a chance to succeed.

The bottoms and edges of doors that don't fit closely can be built up with wood so there is no opening greater than a half-inch, and covered with metal cuff. Openings around pipes, windows, holes in walls, foundation vents, and ventilating fans can be covered with screening or hardware cloth (19 gauge) or sheet metal (20 gauge or heavier). Holes in masonry walls should be cemented shut. It's impossible to list every situation or place that needs rodent-proofing. You'll need to rely on your ability to observe every possible entry to the building.

Rodent competition

There is some competition between the various commensal rodents. Partial separation between rats and mice has been reported in grain stacks, with house mice feeding in the lower areas and rats in upper portions. The smaller size of house mice gives them access to places that are not available to rats. Upon direct confrontation, rats will kill mice.

Pest-control operators have observed that when a building is freed of rats, house mice often move in or increase in numbers. This may be due to reduced competition, but it often results from mice being able to enter and colonize areas that have been made rat-proof, since potential mouse infestations may follow rat-control activities. This should be anticipated by the pest-control operator. House mice are highly competitive against deer mice. Where house mice are present, deer mice will rarely be found.

Rodenticides

Both single-dose and multiple-dose anticoagulant rodenticides are available for rat and mouse control. Although finished baits are available in a wide variety of types, some persons trained in rodent control prefer to mix their own baits with rodenticide concentrates.

When possible, finished baits should be used because they don't require that the applicator handle the concentrate, a more hazardous material.

Pre-baiting

Mice and rats are cautious feeders and may reject new foods or eat only small amounts for the first several

days. Acceptance of a toxic bait can be increased by conditioning rats to feed on a non-toxic version of the same food or "pre-bait."

Pre-baiting is highly recommended before using a single-dose toxicant. After the untreated baits are being eaten regularly, begin the use of treated baits. Pre-baiting may be necessary for two to five days to achieve maximum benefits. The amount of pre-bait eaten helps to determine the amount of toxic bait needed. All uneaten pre-bait should be removed when the toxic bait is applied.

If acceptance of pre-bait is poor, toxic bait should not be applied. Poor acceptance may be corrected by changing bait material or its placement.

Single-dose rodenticides

Single-dose rodenticides will give a quick knockdown of rat and mouse populations, and they may be preferred where rats and mice are abundant or where it's hard to get rats and mice to accept a bait for several days in succession because of competing food items. When rats or mice consume a sublethal amount of an acute toxicant such as zinc phosphide, red squill or ANTU, "bait shyness" or "poison shyness" may result. Because of this bait-rejection problem, these three single-dose poisons shouldn't be used more than twice a year at a given location, and preferably only once. Strychnine acceptance in baits is very poor, usually giving inadequate control.

Multiple-dose rodenticides

Multiple-dose anti-coagulant rodenticides are generally considered much safer than single-dose rodenticides, although red squill has a good safety record. Bait shyness doesn't occur when properly formulated anti-coagulant baits are used. With the exception of brodiafcoum, anti-coagulants cause death to mice and rats after they are fed on for several days. These latter rodenticides are capable of causing death after a single feeding, however, death doesn't occur for several days.

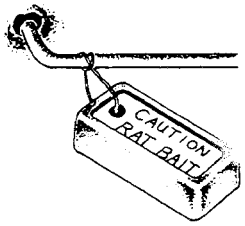
When anti-coagulant rodenticides are used, fresh bait must be made available to rats and mice continuously for at least two weeks or until all signs of feeding cease.

Bait selection and placement

Anti-coagulant baits are available in several types. Grain baits in a meal or pelleted form are often available packaged in small plastic, cellophane or paper packets. These "place packets" keep baits fresh and make it easy to place baits into burrows, walls or other locations. Rats and mice will readily gnaw into these bags to get at an acceptable bait.

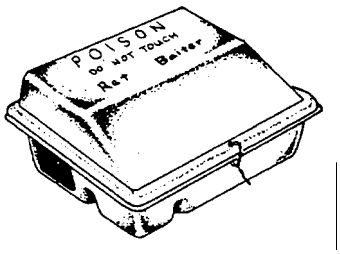
Anti-coagulant baits that have been formulated into paraffin blocks are available from various manufacturers. These blocks are especially useful in sewers or where moisture may cause loose-grain baits to spoil. Acceptance by rats and mice of paraffin-block baits is usually less than acceptance of loose-grain baits. Sodium salts of anti-coagulants are available to be mixed with water. Since rats require water daily, they can be drawn to water stations in some situations. Although mice require little water to survive, water baits used where moisture is scarce can be an effective supplement to other control measures.

Water bait



Paraffin bait block

Use of bait stations (boxes) protects rodenticides from weather and provides a safeguard to people, pets, and other animals. Bait stations should have at least two openings about 2-1/2 inches in diameter for rats or one inch in diameter for mice. The bait boxes should be large enough to accommodate several rats or mice at one time, depending on the problem-rodent species. Bait boxes should be placed next to walls, with openings close to the wall, or in places where rats or mice are active. Rats usually feed in one place, so relatively few bait stations may be needed if correctly located. On the other hand, mice feed in many places and won't travel great distances.



Bait station

Many bait stations may be needed for mice. Space them no farther than ten feet apart, and preferably closer. Baits or traps need to be placed where mice are living, such as in wall spaces, on pallets of feed, etc. All bait boxes should be clearly labeled "Rat Bait" or "Mouse Bait," as the case may be.

Write down the locations of all bait stations so that inspections can be made rapidly and baits replaced quickly. At each inspection, smooth the surface of the granular baits so that new signs of feeding will show readily. Examine paraffin bait blocks for signs of rodent-gnawing. Replace moldy, wet, caked or insect-infected baits with fresh ones. Maintain records of activity indicating where baits have been disturbed, dead rodents found, and droppings or tracks observed.

Tracking powders

Tracking powders are toxicants in dust formulations that are placed in the rodent's runway, near their harborages, or in their burrows, where they travel through them. The dust is picked up on the feet, and the rodent swallows the tracking powder when it grooms itself. Tracking powders can be useful when other toxicants, such as baits, are not accepted or when there is a surplus of food.

Don’t use tracking powders where the rodent or air currents may carry the powder onto human-food surfaces or food-preparation areas. Use bait stations in these situations. Tracking powders can be applied with a shaker on runways, with a dust pump in burrows, or with a duster on wall voids.

Fumigants

Fumigants are often used to control rodents in their burrows in outdoor situations, and sometimes in rail cars and on ships. The operation can be expensive, if the structure has to be tarped. Fumigants are highly toxic to people and animals, and they must not be used in any situation that might expose the occupants of a building to the vapors. Because of the hazards involved with fumigants, only persons licensed for fumigation pest control should use fumigants in any situation involving buildings or other structural enclosures.

Resistance to rodenticides

When genetically immune individual rodents survive a rodenticide treatment, they pass the resistance ability to their offspring. Since many rodent populations have a rather high number of individuals that are less susceptible to most rodenticides, the development of resistance has been a serious problem.

The development of resistant rodent populations is related to the amount of selective pressure that is applied to them. As a result, more thorough rodent control programs can be expected to develop the greatest problems with rodenticide resistance. Pest-control operators should constantly be aware of resistance as a source of control failures. Where rodent-control efforts are regularly applied, periodic shifting of different baits (active ingredients) is advisable.

Rodenticide safety precautions

Certain general safety precautions should be followed besides those appearing on the labels of products. Consider all rodenticides dangerous, and place baits where only rodents can get them.

There are no known rodenticides that don’t present some degree of hazard to animals other than rodents. Persons who formulate rodent baits for their own use should use extreme care in handling the materials. Rubber gloves, an apron, and a proper respirator should be worn. Wash thoroughly after preparing baits, using soap, a brush, and plenty of water. Clean all bait-mixing utensils thoroughly, and use them only for bait preparation. Whenever possible, it’s best to buy prepared or ready-to-use baits, thus reducing risks involved in handling concentrated toxicants. Label all bait containers and stations clearly with appropriate warnings. Store unused bait and concentrates in a locked cabinet, out of reach of children or animals.

Follow the label directions on all rodenticide products carefully. Pick up all dead rats and mice after a poisoning program. Handle the carcasses with tongs or rubber gloves. Dispose of large numbers of rats and mice by incineration or burial. With only a few, especially mice, place them in a plastic bag, close it tightly, and dispose of it with other refuse.

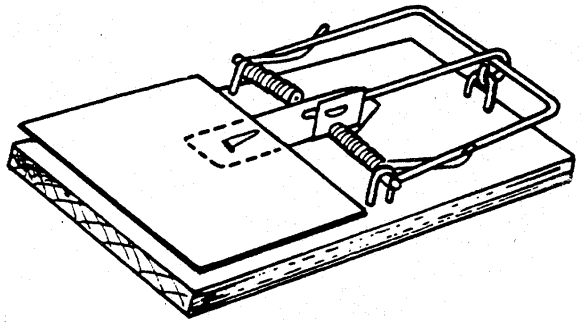
Remove and destroy all uneaten bait at the end of the poisoning period. Never leave single-dose baits exposed for more than three or four days.

Traps

Trapping can be an effective method of controlling rats and mice, but it requires more skill and labor than most other methods. Trapping is recommended where poisons seem inadvisable, and it's the preferred method to try first in homes, garages, and other small structures where there may be only a few rats present. Trapping has several advantages:

1. It doesn't rely on inherently hazardous rodenticides.
2. It permits the user to view his success.
3. It allows for disposal of rodent carcasses, thereby eliminating odor problems, which may occur when poisoning is done within buildings.

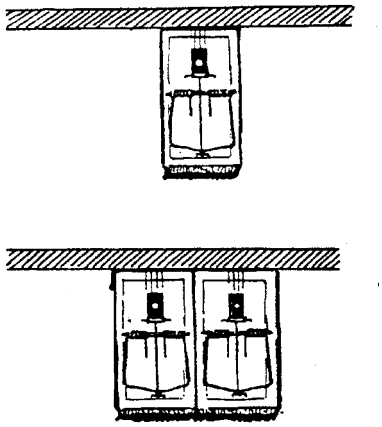
Snap-traps are generally more effective than cage traps. Simple, inexpensive, wood-based snap-traps are readily available. For rats, bait the traps with peanut butter, chocolate candy, dried fruit, or a small piece of bacon tied securely to the trigger. For mice, use bacon, nuts, hard sugar-candy, gumdrops, or peanut butter. Leaving traps unset until the bait has been taken at least once reduces the chance of rats or mice becoming trap-shy.



Enlarged trigger trap

Place traps close to walls, behind objects in dark corners, and in other places where rat and mouse activity has been seen. Place the traps so that the rats and mice following their natural course of travel (usually close to a wall) will pass directly over the trigger. Traps can be set on ledges or on top of pallets of stored materials, if mice are active in such locations. To determine whether rodents are present in a particular area, lightly dust the area with talcum powder. If rodents are present, their tracks will be visible in the dust. Cover all areas of escape with traps. Record the number of traps placed on each job. In food plants, map the location of each trap. This enables someone else to follow up an account, if necessary.

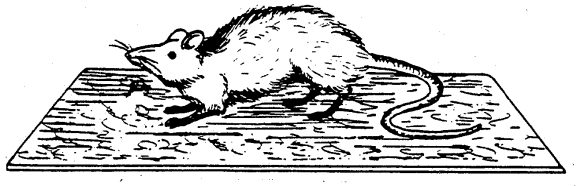
Use enough traps to make the campaign short and decisive. Since mice seldom venture far from their shelter and food supply, traps should be placed from three to ten feet apart in areas where mouse activity is noted. Place them within 20 feet of each other for rats.



Single trap set with trigger next to the wall.
The double set increases your success.

Glueboards

Glueboards are an alternative to traps. Glueboards catch and hold mice and rats trying to cross them in much the same way flypaper catches flies. Like traps, glueboards need to be placed along walls where mice and rats travel. Don't use them where children, pets, or desirable wildlife can contact them. Glueboards lose their effectiveness in dusty areas, and temperature extremes may affect the tackiness of the adhesive.



Glue board

Although rats and mice are easily frightened by strange and unfamiliar noises, they quickly become accustomed to regularly repeated sounds and are often found living in grain mills and factories. Ultrasonic sounds, those above the range of human hearing, have very limited use in rodent control because they are directional and don't penetrate behind objects. Also, they lose their intensity with distance. There is little evidence that sound of any type will drive established mice or rats from buildings. Several types of electromagnetic devices have also been marketed recently with claims of repelling rodents effectively or causing them to behave abnormally.

Scientific tests of many such devices have shown that they failed to control rodents as claimed by their advertising.

BATS

Bats are nocturnal, insect-feeding mammals. Their habits are highly beneficial, since they feed on large numbers of pest-insects such as mosquitoes and cutworm moths. Problems with bats can occur when roosting areas are located in buildings. This may cause offensive odors and distracting noises to be produced. There are also some potential health problems associated with bats. Occasionally, bats may carry rabies. Brown bats are also reservoirs of encephalitis, which may be transmitted to humans or horses by mosquitoes. Histoplasmosis is a fungus disease that can be contracted by inhalation of spores that develop on bat manure. Bats also are hosts of bat bugs, which may move into living areas and bite humans. Bats breed in autumn, before hibernation. Young are born from May to July. The young bats are small and naked, and they may cling to the mother for some time after birth. No nests are built. Most bats are colonial, nesting together in roosting areas.

Bat

Bat Control

Illumination of roosting areas may be an effective repellent. Floodlights can be strung throughout the attic area. After bats have left the roost, the openings must be caulked or built over to exclude bats. Since bats may be attracted by the odors left by the departed bats, a thorough cleanup should also take place. During this cleanup, respiratory protection should be considered to prevent inhalation of histoplasmosis spores.

Bat bugs often are associated with bat-roosting areas. When bats are eliminated, this may force the bat bugs into the living area, where they can be a serious problem. Where bat bugs are present, bat controls should also include bat-bug controls.

SKUNKS

Skunks are nocturnal, reclusive animals of the weasel family. They have omnivorous feeding habits, their diet varying from insects, vegetation, and small rodents to bird eggs and garbage. Although their feeding habits are often innocuous or even beneficial, the sulfurous musk they produce in self-defense makes them undesirable around living areas. Skunks may also damage lawn areas while digging for white grubs. Occasionally, skunks may carry rabies.

The striped skunk is the most common species found throughout Utah. They are similar in size to a house cat, weighing four to ten pounds. Their bodies are black, except for a white stripe on the forehead, with a wide area at the nape of the neck that divides into a "V" and runs along the back.

Spotted skunks are a small species, weighing only about 0.8 to 2.2 pounds. Spotted skunks are black, with white

spotting on the forehead and under each ear. They have four to six broken stripes on the back and sides and a white-tipped tail. Spotted skunks, unlike other skunks, are known to climb trees. They need to be handled with extra care, since they are more excitable than the other species and produce a stronger scent.

Skunks can be active all year. They may sleep for several days during very cold weather, but they don't hibernate. Skunks usually breed once a year, in February or March. Young are born in early May, and litter sizes range from two to ten. The kits are capable of spraying musk about 45 days after birth.

Striped skunk

Skunks usually use an underground den, in which they spend the daylight hours. Dens are seldom occupied by single individuals, with most being occupied by a female and her current brood. Most problems with skunks occur when dens are located under buildings, entered by digging or through foundation openings.

Skunk Control

Best control of skunks is by removal and relocation or exclusion. Skunks may also legally be killed on private lands, if it's essential for safety and property protection. Permits must be obtained to kill skunks on public lands.

Repellents -- Several materials are repellent to skunks and may be useful for moving skunks out of denning area. Ammonia-soaked cloths can be used. Attach the cloths with a string to permit removal. To determine if the animal has vacated, sprinkle the entrance area with flour to detect tracks. Once the animal has departed, the entrance should be sealed to prevent reoccupation.

Exclusion -- Buildings can be made skunk-proof by sealing potential openings around foundations. Cover all openings with wire mesh, sheet metal or concrete. Where access can be gained by digging, obstructions such as fencing should be buried 1-1/2 to two feet deep.

Trapping -- Skunks may be captured in live-traps baited with fish-flavored cat food, sardines, eggs, or peanut butter. Peanut butter is preferred where cats and raccoons might also be caught. The trap should be placed near the den entrance and the sides of the trap covered with a tarp to reduce the chance of the skunk discharging. When moving the trap, it should be approached quietly and moved gently to prevent the skunk from becoming excited. Capturing skunks with leg-hold traps, followed by shooting, is legal but is undesirable because of the high probability of musk release. Leg-hold traps should also not be used in areas where pets and other non-target animals might be trapped.

Odor control -- Neutroleum alpha is the best chemical to help eliminate skunk-musk odor on pets, people, clothing, or residential areas that have been sprayed. Neutroleum alpha is contained in some commercial odor-control products. Diluted solutions of ammonia, chlorine bleach, tomato juice or vinegar may help to eliminate odors from clothing and possessions.

THREATENED AND ENDANGERED SPECIES

The Endangered Species Act (ESA) was passed by Congress to protect certain plants and wildlife that are in danger of becoming extinct. This act requires EPA to ensure that these species are protected from pesticides.

Formulation of the Utah Threatened and Endangered Species/Pesticides Plan is a cooperative effort between federal, state, and private agencies and producers/user groups, and is a basis for continuing future efforts to protect threatened and endangered species from pesticides whenever possible. Furthermore, this plan provides agencies direction for management policies, regulations, enforcement and implementation of threatened and endangered species/pesticide strategies.

EPA has therefore launched a major new initiative known as the Endangered Species Labeling Project. The aim is to remove or reduce the threat to threatened and endangered species from pesticide poisoning. EPA has the responsibility to protect wildlife and the environment against hazards posed by pesticides. The ESA is administered by the U.S. Fish and Wildlife Service (FWS) in the U.S. Department of Interior. The Fish and Wildlife Service will determine jeopardy to threatened and endangered species and report to EPA. EPA and FWS will work cooperatively to ensure that there is consistency in their responses to pesticide users and to provide necessary information. The Utah Department of Agriculture and Food is acting under the direction and authority of EPA to carry out the ESA as it relates to the use of pesticides in Utah.

Maps will show the boundaries of all threatened and endangered species habitats in affected counties. The maps identify exactly where, in listed counties, use of active ingredients in certain pesticides is limited or prohibited. Product labels will be updated as necessary. The updated labels will reflect any additions or deletions to the project. Because EPA's approach to the protection of threatened and endangered species was in the proposal phase at the time this guide was published, any and all of the above information on threatened and endangered species is subject to change and may not be valid.

WORKER PROTECTION STANDARDS

This final rule, which was proposed in 1988 and which substantially revised standards first established in 1974, affects 3.9 million people whose jobs involve exposure to agricultural pesticides used on plants; people employed on the nation’s farms; and in forests, nurseries and greenhouses. The standard reduces pesticide risks to agricultural workers and pesticide handlers. The standard is enforceable on all pesticides with the Worker Protection Standard labeling. The provisions became fully enforceable in January 1995.

Agricultural workers in Utah now have a far greater opportunity to protect themselves, their families and others. These workers will know, often for the first time, when they are working in the presence of toxic pesticides, understand the nature of the risks these chemicals present, and get basic safety instructions.

Among the provisions of the rule are requirements that employers provide handlers and workers with ample water, soap and towels for washing and decontamination and that emergency transportation be made available in the event of a pesticide poisoning or injury. The rule also establishes restricted-entry intervals -- specific time periods when worker entry is restricted following pesticide application -- and requires personal protection equipment (PPE) for all pesticides used on farms or in forests, greenhouses and nurseries. Some pesticide products already carry restricted re-entry intervals and personal protection equipment requirements; this rule raised the level of protection and requirements for all products.

Other major provisions require that employers inform workers and handlers about pesticide hazards through safety training, which handlers have easy access to pesticide-label safety information, and that a listing of pesticide treatments is centrally located at the agricultural facility. Finally, handlers are prohibited from applying a pesticide in a way that could expose workers or other people.

GROUNDWATER CONTAMINATION BY PESTICIDES

Utah has implemented a comprehensive and coordinated approach to protect groundwater from pesticide contamination.

Formulation of the Groundwater/Pesticide State Management Plan is a cooperative effort between federal, state, and private agencies and producers/user groups; it provides a basis for continuing future efforts to protect groundwater from contamination whenever possible. Furthermore, this plan provides agencies with direction for management policies, regulations, enforcement and implementation of groundwater strategies.

While it's recognized that the responsible and wise use of pesticides can have a positive economic impact, yield a higher quality of crops, enhance outdoor activities, and give relief from annoying pests, the Utah Department of Agriculture and Food is authorized by the U.S. Environmental Protection Agency (EPA) to enforce the protection of groundwater from pesticides. Product labels will be updated as necessary.

The Utah Department of Agriculture and Food, in concert with cooperating agencies and entities, admonishes strict compliance with all pesticide labels, handling procedures and usage to protect groundwater in the state.

Groundwater can be affected by what we do to our land. Prevention of groundwater contamination is important, because once the water is polluted, it's very hard and costly to clean up. In some instances, it's impossible, especially if it's deep underground. City and urban areas especially contribute to pollution because water runoff that contains pesticides runs into drainage tunnels, then into a river or an underground stream that drains into the river. For more complete information about what groundwater is and where it comes from, read the study manual "Applying Pesticides Correctly." Shallow aquifers or water tables are more susceptible to contamination than deeper aquifers. Sandy soils allow more pollution than clay or organic soils, because clays and organic matter absorb many of the contaminants.

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended, establishes a policy for determining the acceptability of a pesticide use or the continuation of that use, according to a risk/benefit assessment. As long as benefits outweigh adverse effects, a pesticide can be registered by the EPA. Although the intent of a pesticide application is to apply the pesticide to the target or pest, part of the pesticide will fall on the area around the target or pest. Rain or irrigation water then can pick up the part that isn't degraded or broken down and carry it to the groundwater via leaching.

The major factors that influence the amount of contamination that can get into water are the chemicals' persistence in soil, retention time or time it remains in the soil, the soil type, the time and frequency of the application(s), soil moisture, placement of the pesticide, and the ability of the chemical to persist once in the aquatic environment. Each of these factors will influence the amount of pesticide that can leave the root zone or soil surface and percolate to groundwater.

Although some pesticides may have a high absorption quality, when they are applied to sandy soil, they will still migrate to the water table because there are no fine clay particles or organic matter to hold them. The management and use of pesticides is up to the individual applicator and/or land owner as to whether safe practices are used. Water is one of our most valuable resources; we must keep it as pure as possible.